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MINERALOGICAL ABSTRACTS

Vol. 14—No. 3 September 1959

AGE DETERMINATION AND ISOTOPE MINERALOGY

CARROLL (DOROTHY). *Zircon from a bentonite bed in Martinsburg shale (Ordovician) at Fisher's Hill, Virginia.* Bull. Geol. Soc. America, 1959, **70**, 223–224.

The physical and optical characteristics of the zircon are described. Zircon taken from a bed about 7 ft. above the Chambersburg Limestone (Ordovician), 2 miles south of Strasburg, Virginia, gave a total Pb/ α activity age of 353 m.y. (α /mg/hr, 106; Pb, 15.5 p.p.m.). [M.A. 14-83]

A. L. A.

HURLEY (PATRICK M.), LARSEN (ESPER S., Jr.), & GOTTFRIED (DAVID). *Comparison of radiogenic helium and lead in zircon.* Geochim. Cosmochim. Acta, 1956, **9**, 98–102.

Helium ages were determined on (i) eight gem zircons from Ceylon, (ii) eleven accessory zircons from rocks of the batholiths of Southern California, Sierra Nevada, and Idaho, and (iii) six pegmatitic zircons from Ontario. The Pb ages of the zircons or associated pegmatites ranged from 105×10^6 to 1000×10^6 years and the product of α activity and lead ages, called total irradiation, ranged from 11.2×10^{13} to 1070×10^{13} α/mg . Despite these wide variations data for all but one sample indicated that the zircons had retained an approximately constant proportion of their He (75%). The specimen with almost twice as high a total irradiation as any of the others showed the effects of radiation damage in that it had lost considerably more He than had the other zircons.

J. R. B.

AHRENS (L. H.). *The convergent lead ages of the oldest monazites and uraninites (Rhodesia, Manitoba, Madagascar and Transvaal).* Geochim. Cosmochim. Acta, 1955, **7**, 294–300, 1 fig.

Ages for 5 monazites and 2 uraninites have been derived from data on Pb, Th, and U isotopes. In general, greater calculated ages result using, successively, the ratios $^{208}\text{Pb}/^{232}\text{Th}$, $^{206}\text{Pb}/^{238}\text{U}$, $^{207}\text{Pb}/^{235}\text{U}$, and $^{207}\text{Pb}/^{206}\text{Pb}$. The regular variation of those ages plotted against the $^{207}\text{Pb}/^{235}\text{U}$ age indicates that analytical error is probably slight. Although not proved, lead deficiency in the minerals is indicated; the control of lead loss is thought to be physical rather than chemical.

J. R. B.

WETHERILL (GEORGE W.). *An interpretation of the Rhodesia and Witwatersrand age patterns.* Geochim. Cosmochim. Acta, 1956, **9**, 290–292, 1 fig.

The Pb-U age regularities found by Ahrens for minerals from Rhodesia and Witwatersrand can be explained by assuming lead loss at a particular geological time rather than control of Pb loss by physical processes operating continuously since the formation of the mineral. Similar Pb-U ratios would result for the uraninite, Dominion Reefs, (a) if the mineral were 2930×10^6 years old and had lost Pb 500×10^6 years ago, or (b) if it were 2730×10^6 years old and had lost lead in modern times.

J. R. B.

ASWATHANARAYANA (U.). *Age of the samarskite of Kishengarh, Rajasthan, India.* Bull. Geol. Soc. America, 1959, **70**, 111–114.

Isotopic ages are given for feldspar and samarskite from the pegmatite of the Bajrang mine, 13 miles east of Kishengarh town ($75^\circ 2'$, $26^\circ 36'$). The pegmatite is considered to be post-Delhi in age. The samarskite yielded ages from $^{207}\text{Pb}/^{206}\text{Pb}$ of 579 m.y.; $^{206}\text{Pb}/^{238}\text{U}$, 587 m.y.; and $^{207}\text{Pb}/^{235}\text{U}$, 578 m.y. Feldspar yielded ages from $^{206}\text{Pb}/^{204}\text{Pb}$ of 1200 m.y.; $^{208}\text{Pb}/^{204}\text{Pb}$, 200 m.y.; and $^{207}\text{Pb}/^{204}\text{Pb}$, and $^{206}\text{Pb}/^{204}\text{Pb}$, 1400 m.y. It is suggested that both samarskite and feldspar crystallized 580 ± 20 m.y. ago. The isotopic composition of the lead in feldspar does not correspond to that of ore lead of the same age. The gross discrepancy is attributed to the incorporation into the feldspar of lead which contains an abnormally high concentration of thorium and a low concentration of uranium.

A. L. A.

LARSEN (ESPER S., Jr.), GOTTFRIED (DAVID), JAFFE (HOWARD W.), & WARING (CLAUDE I.). *Lead-alpha ages of the Mesozoic batholiths of western North America.* Bull. U.S. Geol. Survey, 1958, **1070-B**, 35–62.

The ages of rocks from the four great groups of batholiths of western North America—Baja and Southern California, Sierra Nevada, Idaho, and Coast Range—have been determined from the ratio of lead content to alpha activity of the accessory minerals zircon, monazite, thorite, and xenotime. The mean age of 10 intrusive rocks from Baja California,

Guerrero, and Oaxaca, in Mexico is 101 ± 5 m.y.; the batholith of Baja California has been determined as early Late Cretaceous on stratigraphical and paleontological evidence. Twenty-five determinations on rocks from the batholith of southern California, ranging from tonalite to granite, give a mean age of 110 ± 13 m.y.; geological evidence indicates that this batholith is early Late Cretaceous. Determinations on 15 rocks from the Sierra Nevada batholith give a mean age of 102 ± 11 m.y.; on geological evidence the Sierra Nevada batholith is considered Late Jurassic. Age determinations on 16 rocks from the Idaho batholith, geologically dated as Cretaceous, average 108 ± 12 m.y. Age determinations on 16 rocks of the Coast Range batholith including the batholiths of Washington, British Columbia, and Alaska, average 105 ± 13 m.y.; these batholiths are believed to be equivalent in age to the Sierra Nevada batholith. The ages of the four groups of rocks are the same—about 106 ± 12 m.y.; all are believed to be early Late Cretaceous, and the time required for emplacement of the entire batholithic system to be only a few million years. The batholiths make a discontinuous echelon group of intrusive bodies about 4000 miles long and possibly much longer.

K. S.

MOORBATH (S.). Isotopic composition of lead from British mineral deposits. *Nature*, 1959, **183**, 595–596.

Preliminary results of an isotopic study of several British lead ores indicate the usefulness of the method for determining the approximate geological ages of the lead-bearing mineral deposits.

C. H. K.

BLIX (R.), UBISCH (H. v.), & WICKMAN (FRANS E.). A search for variations in the relative abundance of the zinc isotopes in nature. *Geochim. Cosmochim. Acta*, 1957, **11**, 162–164.

10 samples of sphalerite and 8 of six other zinc minerals were analysed for $^{64}\text{Zn}/^{68}\text{Zn}$ variation. None was detected although a variation of 0.1% of the ratio would have been observed.

J. R. B.

ALDRICH (L. T.), WETHERILL (G. W.), & DAVIS (G. L.). Determinations of radiogenic Sr^{87} and Rb^{87} of an inter-laboratory series of lepidolites. *Geochim. Cosmochim. Acta*, 1956, **10**, 238–240.

The reproducibility of isotope dilution methods for obtaining $\text{Rb}^{87}/\text{Sr}^{87}$ ratios is demonstrated. Using a half-life for Rb^{87} of 5×10^{10} years, 4 lepidolites are shown to have ages between 106×10^6 and 2640×10^6 years.

J. R. B.

WETHERILL (G. W.), ALDRICH (L.T.), & DAVIS (G. L.). $\text{A}^{40}/\text{K}^{40}$ ratios of feldspars and micas from the same rock. *Geochim. Cosmochim. Acta*, 1955, **8**, 171–172.

Micas from 3 granites and 4 pegmatites showed higher $\text{A}^{40}/\text{K}^{40}$ ratios than feldspars from the same rocks. A value of 0.85 for the branching ratio of K^{40} seems too low.

J. R. B.

CURTIS (G. H.), EVERNDEN (J. F.), & LIPSON (J.). Age determination of some granitic rocks in California by the potassium-argon method. *California Divn. Mines Spec. Rept.* **54**, 1958, 16 pp. Price \$0.50.

Twenty-one age determinations from three regions (foothill Sierra Nevada and Klamath Mountains, high Sierra Nevada, and Coast Ranges) fall into two age groups within two orogenic epochs. The earlier group is 133–141 m.y. (Nevadan orogeny); the later group is 78–95 m.y. (Santa Lucian orogeny). The data suggest a need to modify the Holmes time scales: namely, to increase the length of the Jurassic from 25 m.y. to at least 40 m.y. and to decrease proportionately the lengths of the Permian, Triassic, and Cretaceous periods. The suggested revision would place the top of the Permian at 201 m.y., the top of the Triassic at 175 m.y., the top of the Jurassic at 133 m.y., and the top of the Cretaceous at 58 m.y. The data suggest an Upper Cretaceous age for Coast Ranges intrusives and a (strike-slip) displacement of at least 300 miles along the San Andreas fault since late Upper Cretaceous time.

K. S.

RANKAMA (KALERVO). A calculation of the amount of weathered igneous rock. *Geochim. Cosmochim. Acta*, 1954, **5**, 81–84.

It is assumed that all A^{40} now in the atmosphere and hydrosphere is the decay product of K^{40} in the earth's crust and that all A^{40} has been released by weathering. Taking the branching ratio for K^{40} as 0.126, a value of $6464 \text{ kg}/\text{cm}^2$ is obtained for the amount of igneous rock weathered during geological time (3.5×10^9 years).

J. R. B.

WICKMAN (FRANS E.). The cycle of carbon and the stable carbon isotopes. *Geochim. Cosmochim. Acta*, 1956, **9**, 136–153.

Knowledge of $^{12}\text{C}/^{13}\text{C}$ ratios in organic sedimentary and carbonate carbon, diamond, graphite, and volcanic gases is related to the ratio of the total of organic sedimentary carbon to that of carbonate carbon. The latter is taken as $2420 \pm 560 \text{ g}/\text{cm}^2$ of the earth's surface and the total of organic sedimentary carbon is estimated as $700 \pm 200 \text{ g}/\text{cm}^2$ of the earth's surface.

J. R. B.

OLSON (EDWIN A.) & BROECKER (W. S.). Lamont natural radiocarbon measurements. *Amer. Journ. Sci.*, 1959, **257**, 1–28. Preprint of first article of Amer. Journ. Sci., Radiocarbon Supplement, **1**, 1–28.

Seven tables of radiocarbon dates for various categories including five of geological samples.

H. W.

ESTON (RALPH E., Jr.). *Hydrogen isotope fractionation between ice and water.* Geochim. Cosmochim. Acta, 1955, **8**, 281-284.

At 0°C ice is enriched in D by nearly 2% compared with the water with which it is in equilibrium. In sea ice the enrichment is offset by the presence of occluded brine.

J. R. B.

ARWAL (A.), RYHAGE (R.), & WICKMAN (FRANS E.). *Natural variations in the relative abundances of the nitrogen isotopes.* Geochim. Cosmochim. Acta, 1957, **11**, 165-170.

Eight samples of Wealden coal, 5 of Carboniferous coal, of living trees, and 2 of caliche showed a variation in the ratio $^{15}\text{N}/^{14}\text{N}$ to the extent of several parts per thousand. Two samples of salammoniac from Vesuvius, Italy, and Sicily, showed $^{15}\text{N}/^{14}\text{N}$ about 1% greater than $\text{N}/^{14}\text{N}$ for air. Variation for all the samples is less than half that observed for stable C isotope ratios. J. R. B.

HOLMES (ARTHUR). *Spitzkop carbonatite, Eastern Transvaal.* Bull. Geol. Soc. America, 1958, **69**, 1525-1526.

Isotopic and spectrographic data support geological evidence that the Spitzkop (Sekukuniland) crystalline limestone is a carbonatite of magmatic origin rather than a xenolith derived from the Transvaal dolomite. Results of isotope analysis by P. Baertschi are given as deviations from a standard in the form $\delta_0 \text{‰} = 1000 (\text{O}^{18}/\text{O}^{16} - S_0)/S_0$ where $S_0 = \text{O}^{18}/\text{O}^{16}$ for a sedimentary limestone taken as standard; similarly for $\delta_c \text{‰}$. Deviations $\delta_0 \text{‰}, (\delta_c \text{‰})$ are: for sedimentary carbonate rocks, +1.6 to -5.2, (+5.2 to -3.2); for magnesian limestone of Transvaal dolomite, -4.0, (-2.3); for the Spitzkop rock, -20.6, (-8.0); for carbonatites, -½ to -22, (-2.3 to -10.4). Spectrographic determinations by R. A. Higazy on the same samples gave: magnesian limestone of Transvaal dolomite, (Spitzkop rock) Ba 5, (650); Sr 5, (10,000); La <30, (400); Y <30, (120) p.p.m.

A. L. A.

APPARATUS AND TECHNIQUES

Optical, X-ray, and other

LARDINI (A. A.). *A double arc goniometer head for crystal orientation, sawing and grinding.* Amer. Min., 1958, **43**, 370-375, 2 figs.

This goniometer head was designed to orientate specimens of about ½ cm. dimensions for cutting. It has a precision of 3' of arc. The head and specimen may be mounted on a back-reflection camera for adjustment of orientation.

B. H. B.

SHBY (G. E.) & KELLAGHER (R. C.). *An apparatus for the study of thermoluminescence from minerals.* Amer. Min., 1958, **43**, 695-706, 7 figs.

An apparatus is described which continuously measures and records the thermoluminescence of a mineral sample in powder or crystal form, at sample temperatures from -100°C to +400°C with irradiation by either X-rays or ultraviolet light. Glow curves are obtained by heating the sample at a constant rate, recording the intensity of thermoluminescence as a function of temperature. Rapidly decaying phosphorescence also can be detected. For all measurements the sample remains undisturbed so problems associated with sample heterogeneity are reduced. Several components of the instrumentation are battery-powered for increased stability.

B. H. B.

DICKBAIN (A. G.) & JOHNSON (W.). *Examination of used chrome-magnesite refractories by petrological and X-ray techniques.* Trans. Brit. Ceram. Soc., 1958, **57**, 511-526, 3 figs., 7 pls.

A description is given of the use of a Guinier focusing

camera for determining silicates, and of the application of microradiography and reflected light techniques for investigating the structure of the opaque regions in used chrome-magnesite refractories. Following the identification of the phases present, chemical analysis allows estimation of their proportions. Iron oxides, CaO, SiO₂, MnO, and P₂O₅ have been added to the bricks from the furnace and Al₂O₃ has been lost; the movement of iron is considered to be mainly by solid diffusion in the magnesium oxide; the silicate assemblage (which contains the CaO and P₂O₅) moves by liquid flow down the temperature gradient.

R. A. H.

KENNEDY (S. W.) & CALVERT (L. D.). *An oxidising atmosphere furnace for use with an X-ray diffractometer.* Journ. Sci. Instruments, 1958, **35**, 61-62, 2 figs.

Describes apparatus which can be fitted to an X-ray diffractometer for high temperature examination of rigid or powdered specimens in controlled atmospheres or in a vacuum.

J. Z.

MATHIESON (A. McL.). *A simple adapter for rotation cameras to improve the accuracy of measurement of identity periods.* Acta Cryst., 1957, **10**, 351-354, 5 figs.

The adapter described may be used without alteration of the conventional X-ray rotation camera; it allows the recording of layer lines up to higher values of ν , the angle between the reflected beam and the vertical. When a suitable function is used and extrapolated to $\nu = 90^\circ$, an accuracy of approx. 0.1% in the measurement of identity periods can be achieved as compared with 0.5-1.0% for the normal film mounting.

J. Z.

AZÁROFF (LEONID V.). *A new method for measuring integrated intensities photographically.* Acta Cryst., 1957, **10**, 413–417, 4 figs.

The method involves the use of a bent-crystal monochromator in conjunction with a Buerger precession camera. The diffracted beams intersect the film in rectangular spots which have nearly constant intensity across the long direction and a narrow plateau across the short direction. The height of this plateau, measured with a densitometer, is proportional to the integrated intensity. The direct beam may be measured directly using a suitable absorbing sheet yielding absolute intensities. Background intensity is extremely low (*cf.* integrating Weissenberg) and the accuracy attainable is better than that of conventional film methods.

J. Z.

TAKÉUCHI (Y.). *X-ray surface reflexion fields on precession photographs.* Min. Journ. [Japan], 1957, **2**, 162–168, 7 figs., 1 pl.

Background patterns on precession films may be useful in estimating absorption corrections.

J. Z.

BOSTRÖM (K.). *A graphical method for the calculation of $|F|^2$ and $|F|$ from equi-inclination Weissenberg photographs.* Acta Cryst., 1957, **10**, 477–479. J. Z.

ROSS (MALCOLM) & CHRIST (C. L.). *Mineralogical applications of electron diffraction. I. Theory and techniques.* Amer. Min., 1958, **43**, 1157–1178, 16 figs., 4 tables.

The interpretation of transmission electron diffraction patterns is similar to those by X-ray in that reciprocal lattice constructions are useful, but differs in geometric plan because of the great difference in radius of the Ewald sphere; for X-ray work the radius is of the order of 1 \AA^{-1} , for electron diffraction with $\lambda = 0.0534 \text{ \AA}$ the radius is 18.7 \AA^{-1} . Electron diffraction patterns from orientated aggregates of thin crystals yield the same unit cell data as those given from a single crystal pattern. Measurements, accurate to within a few tenths of a per cent, are obtained if crystals are thin and the electron beam is oriented to within 5° relative to a major crystal face or cleavage. Patterns of two monoclinic substances, colemanite and potassium chlorate, are shown and the theories and equations necessary for their interpretation are given. B. H. B.

Petrographical, etc.

ATCHLEY (FRANK W.). *Low magnification thin section photography.* Amer. Min., 1958, **43**, 997–1000.

Making of low magnification photographs of thin sections with a photographic enlarger is described. Advice is given on the use of polarized light, exposure, and processing.

A. P.

EMERSON (DONALD O.). *A stage for macro point counting.* Amer. Min., 1958, **43**, 1000–1003, 1 fig.

A standard dual cross feed milling table is adapted as a stage for modal analysis of coarse-grained rocks. A. P.

VIRGIN (WILLIAM W., Jr.) & MASSONI (CAMILLO J.). *A new low-temperature, liquid heating stage.* Amer. Min., 1958, **43**, 606–609, 2 figs.

Plans and specifications are given for a heating stage for the temperature range 30° – 300°C designed for use on a petrographic microscope.

A. P.

THEOBALD (PAUL K., Jr.). *The gold pan as a quantitative geologic tool.* Bull. U.S. Geol. Survey, 1957, **1071-A**, 1–54, 4 figs., 8 tables.

In a quantitative investigation the gold pan has been shown to be an extremely satisfactory tool for concentrating heavy minerals. The effect of grain size, grain shape, specific gravity, and type of material sampled are evaluated.

R. A. H.

ROSENBLUM (SAM). *Magnetic susceptibilities of minerals in the Frantz Isodynamic magnetic separator.* Amer. Min., 1958, **43**, 170–173, 1 fig.

Instrumental settings are given for the separation of about 50 minerals.

A. P.

RITTMANN (A.) & EL HINNAWY (E. E.). *A note on the quantitative mineralogical analysis of black sands.* Egypt. Journ. Geol., 1958, **2**, no. 1, 67–69. Summary in Arabic, *ibid.*, 70.

The distinction between the constituent minerals of black sands from Rosetta, Egypt, is carried out under a heating microscope with the minerals in question mixed with sulphur powder and heated to 125°C . According to the authors the following minerals are easily distinguished by this method: zircon, monazite, rutile, titanite, ilmenite, magnetite, garnet, hornblende, sillimanite, and epidote.

E. M. EL S.

WATSON (JOHN H. L.). *Carbon replication of particulates and ultramicroscopic crystals.* Anal. Chem., 1957, **29**, 562–566, 10 figs.

Carbon replicas of single crystals and particles of colloidal size can be used in conjunction with electron microscopy to provide determinative crystallographic data.

R. A. H.

[GRITZAYENKO (G. S.), GORSHKOV (A. I.), & FROLOVA (K. J.)] Грицаенко (Г. С.), Горшков (А. И.), и Фролова (К. Е.). *Об изучении минералов методом реплик.* [On the study of minerals by the replica method.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 269–276, 10 figs.

This is a brief discussion of replica methods as applied to minerals and is illustrated by ten photographs of quartz, olomite, halloysite, and other minerals, obtained by these methods in an electron microscope.

S. I. T.

MONS (R. C.) & GATES (R. M.). *Misconception of the intermediate refractive index*. Bull. Geol. Soc. America, 1957, **68**, 1413.

R. A. H.

SHER (D. J.). *Refractometer perils*. Amer. Min., 1958, **43**, 777-780, 1 fig., 3 tables.

A series of tests measuring the index of five special glassates, using three oils and five wavelengths of light, with an Abbe prism refractometer shows the precision to be between 0.0001 and 0.0004. The tests show that the standard refractometer reads slightly high in the low range and correctly elsewhere ; a high index instrument was essentially correct in the middle range but read too high in the low range and too low in the high range. The chief error to avoid is using too much oil, which may result in a wedge-shaped oil film.

B. H. B.

KAMB (W. B.). *Isogynes in interference figures*. Amer. Min., 1958, **43**, 1029-1067, 19 figs., 7 tables.

The interpretation of interference figures of crystal lattices using the skiodrome theory leads to qualitative and quantitative errors ; formulae derived from this theory and that of Michel-Lévy are unsatisfactory. New formulae are derived by considering the effect on isogyre position of rotation of the polarization plane by the optical system. These formulae provide a means of determining $2V$ in centered $Bx\alpha$ figures and in centered $Bx\alpha$ figures of large $2V$ by measuring the angle of stage rotation μ_0 required to disperse the isogynes from a centered cross to the edge of the interference field of view ; the half-aperture of the conoscope must be known. It follows that centered $Bx\alpha$ and $Bx\beta$ figures can be distinguished. A comprehensive analysis, developing 42 formulae, is applied to the uniaxial flash figure, the acute and obtuse bisectrix figures, and the optic normal figure. In formula 33c (p. 1059) $\mu\alpha$ should be $\mu\beta$.

B. H. B.

THOMPSON (CHARLES E.) & LAKIN (H. W.). *A field chromatographic method for determination of uranium in soils and rocks*. Bull. U.S. Geol. Survey, 1957, **1036-L**, 209-220.

WARD (F. N.) & MARRANZINO (A. P.). *Field determination of uranium in natural waters*. Ibid., **1036-J**, 181-192.

Uranium in rocks and soils is determined by placing an aliquot of a nitric acid-aluminium nitrate solution of the sample on a chromatographic strip, the uranium being separated by the upward flow of a solvent mixture and

detected by a potassium ferrocyanide solution. The method is applicable to samples with 4 to 1200 p.p.m. U, with possible upwards extension. Uranium may be separated from a water sample by a phosphate collector, and determined by a similar chromatographic procedure ; the method for waters is applicable for samples with 2 to 200 p.b. (parts per billion or thousand million). [M.A. **13**-75, **14**-12]

R. A. H.

WALTER (D. R.). *Cleaning materials*. Rocks & Minerals, 1958, **33**, 431.

Suggestions are given for cleaning smoke-blackened specimens, for removing clay crusts, and for cleaning sulfide minerals.

R. S. M.

Chemical, gravimetric and volumetric

CHALMERS (ROBERT A.) & PAGE (E. S.). *The reporting of chemical analyses of silicate rocks*. Geochim. Cosmochim. Acta, 1957, **11**, 247-251.

It is suggested that analytical results should show (i) the mean of duplicate analyses, (ii) the estimated standard deviation, (iii) the observed difference between duplicate determinations, and (iv) results rounded off to imply estimated error. [M.M. **30**-481]

J. R. B.

TANANAEV (N. A.) & SMYSHTYAEV (S. I.). [The decomposition of silicates with ammonium fluoride. Trudy Ural'sk. Politekh. Inst., 1957, 101-106.] Anal. Abstr., 1958, **5**, abstr. 4038.

The single or multiple treatment of silicates with a fivefold excess of powdered NH_4F gives complete decomposition on heating at 300° to 400°C for 3 to 15 minutes.

R. A. H.

SATO (T.) & IKEGAMI (A.). [A rapid routine analysis of limestone. Japan Analyst, 1957, **6**, 706-711.] Anal. Abstr., 1958, **5**, abstr. 2905.

The sample (0.2 g) is decomposed with HClO_4 and HCl and divided into three portions for EDTA titration of Ca, EDTA titration of Mg, and photometry of Fe with nitroso-R salt. A further 0.2 g sample is fused with NaOH and two aliquots are used for photometry of Si with molybdate and for photometry of Al with 8-hydroxyquinoline in benzene.

R. A. H.

THOMPSON (R. R.). *Method for determining non-ignited acid insoluble residue of carbonate rocks*. Bull. Min. Industr. Expt. Station [Pennsylvania State Univ.], 1958, **71**, 15-18.

A wet chemical method has been developed for determining the non-ignited acid insoluble residue in limestones. This has the advantage over the normal method, involving

the determination of ignited acid insoluble impurities, of leaving a residue suitable for further microscopic examination and allowing three times as many determinations in a given period. The percentage amounts obtained by each method are compared with the chemically determined values for SiO_2 , Al_2O_3 , and Fe_2O_3 in 27 rock samples. R. A. H.

YOSHIMURA (JUN) & WAKI (HIROHIKO). *Systematic analysis of silicates by the use of ion-exchange resin.* Japan Analyst, 1957, **6**, 362-369.

Following decomposition, solution, and acidification the rock solution is passed through a column of Dowex 1-X8 (Cl), the resin then being eluted with various strengths of HCl to yield eluates containing Na, K, Mg, Ca, and Al; Mn, Ti, and P; and Fe. These fractions are then further separated by passage through other resins, and finally the various metal ions are determined by the usual methods.

R. A. H.

BENNETT (H.), HAWLEY (W. G.), & EARDLEY (R. P.).
1.—*Rapid analysis of some silicate materials.* Trans. Brit. Ceram. Soc., 1958, **57**, 1-28, 2 figs.

SiO_2 is determined by the formation of silicomolybdic acid, followed by the precipitation of its quinoline salt which is filtered and weighed. Al_2O_3 is determined gravimetrically with 8-hydroxyquinoline; this is not suitable, however, for samples with high $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratios, such as sands. CaO and MgO are determined with EDTA, Fe_2O_3 and TiO_2 colorimetrically, and the alkalies flame-photometrically.

R. A. H.

BRITISH STANDARDS INSTITUTION. *Methods for the analysis of glass. II. Recommended procedure for the analysis of soda-boric oxide-alumina-silica glasses of high silica and boric acid content.* British Standard **2649** : Pt. 2, 1957, 20 pp. [M.A. **13-75**]

R. A. H.

RUGGIERI (R.). *Hydrazinophthalazines. I. Organic reagents for the determination of iron.* Anal. Chim. Acta, 1957, **16**, 242-245.

— — — *Hydrazinophthalazines. II. Organic reagents for the determination of vanadium.* Ibid., 246-248.

R. A. H.

CLARK (ROBERT E. D.). *o-Dithiols in analysis. Part III. Reactions of toluene-3:4 dithiol in acetate buffer and alkaline solutions: toluene-3:4-dithiol as a reagent for copper, cobalt, iron^{II}, antimony^V and thallium.* Analyst, 1957, **82**, 177-182.

R. A. H.

FRITZ (JAMES S.), RICHARD (MARLENE JOHNSON), & BYSTROFF (ANN SUTTON). *Complexometric titrations following cupferron separation of interferences.* Anal. Chem., 1957, **29**, 577-579.

Details are given for the titration with EDTA of Mg, Ca, Mn, Zn, Cd, Pb, Co, and Ni following separation from Fe, Th, Zr, Ti, Sn, or Bi by extraction of the tri- and tetravalent metals from water into an immiscible solvent of benzene and isoamyl alcohol. Separation from Al, Cu, or the rare earths is incomplete.

R. A. H.

FRITZ (JAMES S.), LANE (WILLIAM J.), & BYSTROFF (ANN SUTTON). *Complexometric titrations using azoxine indicators.* Anal. Chem., 1957, **29**, 821-825.

Cd, Co, Cu, Pb, Ni, Th, Y, Zn, and rare earths can be accurately titrated in acid solution with EDTA using the 7-(arylazo)-8-quinolinol-5-sulfonic acids as indicators.

R. A. H.

GILFRICH (JOHN V.). *Determination of aluminum in aluminum-iron alloys.* Anal. Chem., 1957, **29**, 978-980.

Interfering elements are adsorbed by an ion exchange resin, the non-adsorbable Al being then determined gravimetrically by precipitation with ammonium hydroxide.

R. A. H.

CHIEN (TSUI-LIN). [Determination of aluminium after isolation with sodium hydroxide and sodium chloride.] Acta Chim. Sinica, 1957, **23**, 324-329.] Anal. Abstr., 1959, **6**, abstr. 75.

A method applicable to ores and silicate rocks is described in which Al is separated from Fe and Ti by excess of NaOH and NaCl, and then titrated with EDTA using haematoxylin as indicator.

R. A. H.

ISAKOVA (N.) & MIREVA (S.). [Volumetric determination of aluminium in clays with 8-hydroxyquinoline without preliminary removal of silicic acid.] Khim. i Ind., Sofia, 1957, **29**, 25-27.] Anal. Abstr., 1958, **5**, abstr. 3646.

After fusion, solution, and treatment of the clay, 8-hydroxyquinoline is added, and later also KBr, and the solution is titrated with KBrO_3 . After 2 minutes KI is added and the liberated iodine titrated with $\text{Na}_2\text{S}_2\text{O}_3$, the quantity of Al_2O_3 being found by the difference of the titrations.

R. A. H.

MUTO (SATORO). *Analytical studies of boron. VI. Determination of boron using ion-exchange resin.* Bull. Chem. Soc. Japan, 1957, **30**, 881-885.

The solution is freed from other ions by ion-exchange and B is determined by titration or colorimetrically [M.A. **13-76**]. Some results are given for rock samples.

R. A. H.

BISHOP (E.). *The decomposition of cyanates in acid solution, with reference to the analysis of chromium-bearing minerals and alloys.* Analyst, 1958, **83**, 588-591.

The formation of chromamines, whose hydroxides are soluble in solutions buffered with ammonium salts thus causing incomplete precipitation of Cr, may be avoided by the slow production of ammonia in the solution by hydrolysis of a cyanate. This method has the advantage of increasing the particle size and filterability of the precipitate; the precipitation is rapid and quantitative. The procedure has been successfully employed in the analysis of chromite and chrome ironstones.

R. A. H.

ATZAK (R.) & DOPPLER (G.). *Die Bestimmung von Chrom, Eisen und Aluminium mit Äthylendiamintetraacetat bei gleichzeitiger Anwesenheit aller drei Kationen.* Zeits. Anal. Chem., 1957, **156**, 248-257.

Fe is determined first with EDTA by titration at 50°-60°C and pH 1.5 to 2.0; Fe + Cr are then determined together by titration at pH 5.0, after the solution has been boiled for five minutes. Finally, following previous boiling, Fe + Cr + Al are determined at pH 5.0 and 40°C.

R. A. H.

SHEHYN (HENRI). *Acidimetric determination of fluorine after ion exchange: application to aluminium fluoride, cryolite, and fluorspar.* Anal. Chem., 1957, **29**, 1466-1470.

The sample is fused with mixed alkali carbonates and silica, the melt leached with water, and the cations removed with a cation exchange column. Titration of the effluent with standard alkali gives an accurate measurement of the amount of fluorine present.

R. A. H.

NAZARENKO (V. A.), LEBEDEVA (N. V.), & RAVITSKAYA (R. V.). [Determination of germanium in ores, coals and industrial wastes. Zavod. Lab., 1958, **24**, 9-13.] Anal. Abstr., 1958, **5**, abstr. 3292.

This method, suitable for determining up to 0.5 µg of Ge in 1g of sample, is based on the extraction of Ge with CCl₄ from a 9N HCl solution followed by re-extraction with water and colorimetric determination with phenylfluorone.

[M.A. 13-142, 510, 511, 513, 573]

R. A. H.

KVAPIL (M.). [Analysis of dolomites, ankerites and magnesites in the presence of larger amounts of manganese. Rudy, 1957, **5**, 4-6.] Anal. Abstr., 1958, **5**, abstr. 4149.

The R₂O₃ group is precipitated with hexamine and the Mn in the filtrate is precipitated with diethyldithiocarbamate and extracted with chloroform or masked with triethanolamine.

R. A. H.

BLUNDY (P. D.) & SIMPSON (M. P.). *The determination of nickel by a solvent-extraction method.* Analyst, 1958, **83**, 558-561, 1 fig.

The rapid determination of Ni in solutions containing

U, Th, Fe, and Cr is described, using the aqueous insoluble 4-methylcyclohexane-1:2-dionedioxime complex of Ni, extracted with toluene. [M.A. 13-436, 512] R. A. H.

STONHILL (L. G.). *The determination of niobium and tantalum in titanium dioxide pigments.* Analyst, 1958, **83**, 642-644.

A method involving the elution of a fluoride solution of the sample with an HF-ethyl methyl ketone-water solvent and the cellulose-column technique for the recovery of a pure Nb-Ta concentrate was used to obtain the Nb and Ta content of thirteen ilmenite and two rutile samples. Results varied from 0.0025 to 0.28% Nb₂O₅ and 0.0005 to 0.08% Ta₂O₅.

[M.A. 13-76, 258]

R. A. H.

HIRANO (S.) & KAWAGUCHI (H.). [Rapid determination of phosphate in ore and calcium superphosphate. Japan Analyst, 1958, **7**, 107-108.] Anal. Abstr., 1958, **5**, abstr. 3681.

The determination of orthophosphate in phosphate ore, with AgNO₃, followed by alkalimetric titration of the resulting HNO₃, uses EDTA as masking agent for Ca, Al, and Fe.

R. A. H.

DELLAMONICA (E. S.), BINGHAM (E. W.), & ZITTLE (C. A.). Effect of trichloracetic acid on determination of silicate and phosphate with molybdate reagent. Anal. Chem., 1958, **30**, 1986-1988.

Trichloracetic acid enhances by 26% the colour obtained with the molybdate reagent for Si, and when it is present the Si colour is independent of the H₂SO₄ concentration and is not influenced by the volume to which the molybdate is added.

R. A. H.

SPOREK (K. F.). Determination of phosphate in uranium ores, concentrates and liquors via an EDTA titration. Chemist Analyst, 1958, **47**, 12-13.

R. A. H.

GORNYI (G. YA.). [Separation of scandium from sedimentary rocks, coal ash and certain minerals prior to its determination. Ukr. Khim. Zhur., 1957, **23**, 792-798.] Anal. Abstr., 1959, **6**, abstr. 86.

The conditions are studied for the separation of small amounts (0.001 to 0.02%) of Sc from a large number of sedimentary rocks containing 0.1 to 0.5% rare earths but not containing Th. The co-precipitation of Sc with the rare earths as oxalate becomes quantitative if Al is first removed with excess NaOH; Sc may be precipitated from a solution of the oxalate by the addition of phytin.

R. A. H.

ARCHER (E. E.). The titrimetric determination of sulphate with lead nitrate as titrant and dithizone as indicator. Analyst, 1957, **82**, 208-209.

R. A. H.

SPOREK (K. F.). *Complexometric determination of sulphate.* Anal. Chem., 1958, **30**, 1032-1035.

A rapid method for the determination of sulphate in materials obtained during the extraction of uranium from ores is based on precipitation as lead sulphate from acid solution containing isopropyl alcohol. The precipitate is dissolved in excess EDTA and the excess determined by back titration with zinc chloride solution. R. A. H.

LUPAN (S.). [Complexometric determination of thorium in the presence of cerium. Rev. Chim., Bucharest, 1958, **9**, 101-102.] Anal. Abstr., 1958, **5**, abstr. 4054.

R. A. H.

CLINCH (J.) & SIMPSON (E. A.). *The determination of thorium and lanthanons in monazite.* Analyst, 1957, **82**, 259-269.

A double precipitation with ammonium oxalate removes elements other than calcium from the thorium-lanthanon mixture; benzoic acid is used to separate and determine the thorium while lanthanons can be separated from calcium and precipitated as hydroxides. Results for various monazites give coefficients of variation of 1% and 0.4% for thorium and lanthanons respectively [M.A. 13-437].

R. A. H.

ZVEREV (L. V.) & PETROVA (N. V.). [New method of determining sulphide tin in ores. Zavod. Lab., 1957, **23**, 1403-1405.] Anal. Abstr., 1958, **5**, abstr. 2935.

Sulphide, but not oxide, ores of tin react with Cl or Br in CCl_4 in the presence of elementary S to give SnCl_4 or SnBr_4 , which dissolves in the CCl_4 . This allows the separation, and later extraction and determination, of the sulphide Sn from that in cassiterite which is insoluble in CCl_4 .

R. A. H.

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CURTIS (DIANE). *Selected annotated bibliography of the uranium geology of igneous and metamorphic rocks in the United States.* Bull. U.S. Geol. Survey, 1958, **1059-E**, 205-262. Price 55 cents.

K. S.

FIX (CAROLYN E.). *Selected annotated bibliography of the geology and occurrence of uranium-bearing marine black shales in the United States.* Bull. U.S. Geol. Survey, 1958, **1059-F**, 263-325. Price 25 cents.

K. S.

IGLESIAS (DOLORES) & MENEGHAZZI (MARIA DE L.). *Bibliographia e indice da geologia do Brazil, 1943-1944.* Dept. Nac. Prod. Mineral, Div. Geol. Min., 1949, Bol. **131**, 52 pp.

MURTHY (T. S.) & SARMA (D. V. N.). *Separation of thorium from rare earths.* Zeits. anal. Chem., 1958, **161**, 114-111.

A method is described for separation of Th from rare earths in monazite based on the difference of stability of EDTA complexes towards oxine. R. A. H.

WAHLBERG (JAMES S.), SKINNER (DWIGHT L.), & RADEN (LEWIS F., Jr.). *Volumetric determination of uranium. Titanous sulfate as reductant before oxidimetric titration.* Anal. Chem., 1957, **29**, 954-957.

[M.A. 13-258, 14-11].

R. A. H.

DESAI (M. W.) & MURTHY (T. K. S.). *Volumetric determination of uranium in presence of iron.* Analyst, 1958, **83**, 126-129.

The method is based on the oxidation of reduced U^{IV} with ferric sulphate and titration of the excess of ferric iron iodimetrically. R. A. H.

VINOGRADOV (A. V.) & SHPINEL (V. S.). [Phosphate-8-hydroxyquinoline method for the separation and volumetric determination of zirconium. Atomn. Energiya, 1957, **3**, 130-134.] Anal. Abstr., 1958, **5**, abstr. 3672.

A combination of the phosphate method for the separation of Zr from Ti and Th, and an 8-hydroxyquinoline method for separating the Zr from Ta and Nb, and for determining it, may be used in the analysis of ores [M.A. 13-76, 437, 573]. R. A. H.

BRICKER (CLARK E.) & WATERBURY (GLENN R.). *Separation and determination of microgram quantities of zirconium.* Anal. Chem., 1957, **29**, 558-562.

The separation of Zr is effected by a double precipitation with *p*-bromoandelic acid and determined by its colour reaction with chloranilic acid. R. A. H.

BIBLIOGRAPHIES AND BOOK NOTICES

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Author catalogue, with subject and locality index.

J. Ph.

[МАКСИМЕНКО (Ф. Ф.)] Максименко (Ф. Ф.). Литература по минералогии Украины за 1956 год. [Literature on the mineralogy of the Ukraine for 1956.] Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.] 1957, no. **11**, 381-401.

Three hundred and seventy titles of papers and books are given in an alphabetical order of author's names, prefaced by an analytical classification by subjects.

S. I. T.

ШАФРАНОВСКИЙ (И. И.) Шафрановский (И. И.). Кристаллы минералов. [The crystals of minerals.] Часть I. Плоскогранные формы. [Part I. Flat-faced forms.] Изд. Ленингр. Унив. [Publ. Leningrad Univ.], 1957, 222 pp., 70 figs. Price 11 r. 25 k.

The title of this book is misleading : it is a book on crystal morphology, with a very brief reference to crystalline minerals. It bears its present title because it is the first volume of a series of publications which will eventually cover the field of mineral crystallography. Only a brief statement of the contents is possible here. Chap. I (pp. 18–5)—simple forms of flat-faced monocrystals ; geometrical forms and their distribution among its syngonies and among some six hundred mineral species ; tabulation and discussion of 146 crystalline varieties and 1403 structural varieties of simple forms ; edge forms ; homology as defined by Mikheev. Chap. II (pp. 116–177)—forms of crystals and their relation to the fine structure ; space lattices and the law of Bravais especially as expanded by Donnay and Parker ; frequency orders of faces in various crystals ; X-ray method of determination of important faces (Mikheev's method) ; Niggli contributions ; growth of crystals and other topics. Chap. III (pp. 178–204)—relation between the form of crystals ; the conditions of their formation ; and the symmetry of the medium. Chap. IV (pp. 205–221)—methods of study.

S. I. T.

ОСТ (РУДОЛФ). Тěžké minerály. [Heavy minerals.] Praha (Publ. Czechoslovak Acad. Sci.), 1956, 240 pp., 73 figs., 20 pls. of microphotos, 65 punched cards for identification of heavy detrital minerals. Price 25.50 kcs.

The author presents a thorough treatise on methods used in the investigation of detrital minerals from both scientific and practical standpoints : separation by heavy liquids and melts, by electric current, and electrostatic conductivity. Later chapters contain paragenetic data on minerals concentrated in detrital sediments, determinative optical data, physical and microchemical tests for heavy minerals. New directions are given for the use of molten sulphur as an immersion liquid of high refraction index. Special descriptions of detrital minerals are given and illustrated, with detailed data on their occurrence in sedimentary rocks from Czechoslovak localities. Numerous microphotos made by the author and well reproduced on the plates accompany the descriptions.

F. S.

HEINRICH (E. W.). *Mineralogy and geology of radioactive raw materials.* New York (McGraw Hill), 1958, xiv + 654 pp. Price £5 12s. 6d.

HORN (C. L.). *The iron ore industry of Minnesota and the problem of depleted reserves.* 1956, 195 pp.

LIPSON (H.) & TAYLOR (C. A.). *Fourier transforms and X-ray diffraction.* London (Bell), 1959, vii + 76 pp. Price 18s. 6d.

SHAUB (B. M.). *The book of mineral photographs.* Northampton, Massachusetts (Shaub), 1957, 118 pp., 100 photographs.

JONG (W. F. DE). *Kompendium der Kristallkunde.* Vienna (Springer-Verlag), 1959, viii + 258 pp., 227 figs. Price £3 15s. 0d. (\$10.50).

R. A. H.

Radioactivity and Age Relations. Amer. Journ. Sci., Radiocarbon Supplement, vol. 1 published May, 1959, annually thereafter. Price \$2.50 up to 1st Jan. 1960; thereafter \$4.50.

Announcement has been received of a new periodical in which will be listed all age determinations based on radiocarbon measurements. The first article is 'Lamont natural radiocarbon measurements'—see Olson E. A. & Broecker (W. S.) M.A. 14–164.

H. W.

NEDELMANN (H.). *Kohlechemie.* Essen (West-Verlag), 1957, 64 pp., figs. in text unnumbered. Price DM10.

RAAZ (F.) & TERTSCH (H.). *Einführung in die geometrische und physikalische Kristallographie und in deren Arbeitsmethoden.* Wien (Springer-Verlag), 1958, xii + 367 pp., 384 figs. Price DM48.

ROUBAULT (M.). *Géologie de l'Uranium.* Paris (Masson), 1958, xi + 462 pp., 205 figs., 2 pls. Price £5 12s. 0d.

SCHNACKNE (S.) & DRAKE (N. D.). *Oil for the world.* (Esso Petroleum Co.), 1950, 99 pp., figs. in text unnumbered. Price 12s. 6d.

ANGEHELLI (V.). *Los minerales de uranio, sus yacimientos y prospección.* Buenos Ayres (Com. Nac. Energia Atomica), 1958, 161 pp., 13 figs., 1 pl. (coloured). Price \$15.

J. Ph.

CLAY MINERALS

Petrology

ROBERTSON (R. H. S.). *The earths of Theophrastus.* Classical Rev., 1958, 72, 222–223.
In their translation of Theophrastus' *Περὶ λίθων*, E. R.

Caley and J. F. C. Richards show when lime, gypsum, and plaster of Paris, respectively, were meant by Tymphaic earth. Samian earth is convincingly translated as kaolinite : Melian earth may have been the very fine-grained quartz

now called milowite : but Kimolian earth cannot be sepiolite ; like English fuller's earth, it was essentially calcium-montmorillonite.

J. Ph.

LIPPI-BONCAMBI (C.), MACKENZIE (R. C.), & MITCHELL (W. A.). *The mineralogy of some soils from Central Italy*. Clay Min. Bull., 1955, **2**, 281-288.

Seven soils, mainly derived from calcareous sediments, from the Umbrian region of Italy, were examined by optical, X-ray, and thermal methods. In the clay fraction illite (45-85%) predominates except in the Mediterranean *terra rossa* which contains 65-70% kaolinite. Halloysite, montmorillonite, vermiculite, and chlorite occur in varying small amounts. Goethite and hematite never exceed 5% and gibbsite (1-2%) was only detected in two instances. The sand fractions were difficult to examine optically because of the high degree of weathering.

B. D. M.

GALLITELLI (P.). *Clay minerals of the argille scagliose of the Modenese Apennines*. Clay Min. Bull., 1955, **2**, 275-280.

Three samples of *argille scagliose* containing foraminifera of Upper Cretaceous age and taken close to ophiolites were examined by optical, X-ray and thermal methods. The red and grey clays from Varana and Castelvecchio contain chlorite, hydrated illite, disordered kaolinite, and possibly an interstratified illite-kaolinite mineral, with hematite and goethite in the red clays. The clay from Sassomorello is characterized by a 22-28 Å swelling chlorite, the possible origin of which is discussed. No antigorite is found even close to a serpentine mass.

R. C. M.

PARHAM (W. E.). *The petrology of the underclay of the Illinois No. 2 coal, Pennsylvanian, in the Eastern Interior Basin*. MSc. thesis, Univ. Illinois, 1958, 30 pp.

The non-clay minerals were quartz, muscovite, pyrite, zircon, tourmaline, limonite, rutile, ilmenite, leucoxene, and chlorite. The pyrite occurred as striated cubes, octahedrons, pyritohedrons, spherulites, irregular masses, and replacing tiny rootlets and plant structure. The tourmaline occurred as fragments, well-rounded grains, euhedral crystals, and as overgrowths on other well worn tourmaline grains ; colors were brown, tan, pink, and colorless, the fragments being darker and more pleochroic, the overgrowths usually lighter than the cores. The particle size of the underclay is usually reflected in the particle size of the subjacent sediment. The average median size in microns of the underclay resting on another underclay is 1.98, on limestone 3.48, on shale 4.21, on siltstone 7.67, and on sandstone 21.71.

W. A. Wh.

WAHL (F. M.). *A petrographic study of the underclay of the No. 5 coal in Illinois*. MSc. thesis, Univ. Illinois, 1957, 45 pp.

The non-clay minerals observed were quartz, pyrite, tourmaline, zircon, leucoxene, magnetite, ilmenite, garnet, chlorite, muscovite, feldspar, and hypersthene. Pyrite, the most abundant of the heavy minerals, occurred as spherical nodules, irregular fragments, and euhedral pyritohedron and cubes. The tourmaline is colorless to light brown with sharp euhedral outline and is thought to be authigenic. The feldspars include Na and K species, the latter being the more common. Illite and mixed-layer illite-montmorillonite are the most abundant clay minerals. Kaolinite occurred more frequently in the upper portion of the underclay and was missing in the northwestern and north-central part of the State ; chloritic clay mineral was identified in the north and northwest. The particle size of the underclay tended to increase from the north to the south. W. A. Wh.

SPENCER (C. W.). *A petrographic study of the underclay of the No. 6 coal in Illinois*. M.Sc. thesis, Univ. Illinois, 1955, 56 pp.

The non-clay minerals include quartz, albite, orthoclase, less abundant oligoclase and microcline, muscovite, chlorite, biotite, calcite, chalybite, gypsum, zircon (sometimes zoned), tourmaline, leucoxene, rutile, pyrite, garnet, and hornblende. Tourmaline includes euhedral, elongate, greenish brown schorlomite, which is considered from its habit to be authigenic, and an equant, rounded blue to blue-black variety. Clay minerals determined by d.t.a. are illite and little kaolinite and montmorillonite. The particle size increases from north to south.

W. A. Wh.

ZEN (E-AN). *Clay mineral-carbonate relations in sedimentary rocks*. Amer. Journ. Sci., 1959, **257**, 29-43.

Textural relations in devitrified volcanic glass (quartz, calcite, 10 Å micaceous 'illite', and iron oxide or hydrate also less certainly kaolinite, chlorite, and possibly an alkali feldspar) from submarine sediments from Peruvian coastal waters suggest attainment of chemical equilibrium because the seven-component system dolomite-calcite-chlorite-kaolinite-quartz-H₂O-CO₂ has theoretical phase relations that agree with petrographic data from the sediments. Calcite may be compatible with kaolinite, notwithstanding previously published work. Montmorillonite and mixed-layer clays, if present, may change the phase diagrams, but probably not with respect to the calcite-kaolinite binary join.

H. W.

TSUZUKI (Y.). *Clay minerals of weathering and sedimentary origins from the Higashiyama district, Nagoya City*. Journ. Min. Soc. Japan, 1957, **3**, 158-164 (in Japanese).

The species of iron oxide minerals and their amounts in a series of weathered gravels and silts vary with the weathering conditions, while the essential clay mineral is in all cases

loysite. The temperature of the d.t.a. exothermic peaks high for the clay minerals in weathered gravels, low for those in soils near the present surface, and intermediate for those in silts. This is believed to be related to the degree of crystallinity of the clay minerals.

R. A. H.

KUNAGA (M.). *Nacrite-bearing kaolin clay from the Kasuga mine, Kagoshima Prefecture, Japan.* Min. Journ. [Japan], 1957, **2**, 103–113, 4 figs., 1 pl.

A hypogene kaolin clay occurring as a hydrothermal alteration product in an epithermal gold ore deposit has been shown by microscope and d.t.a. to consist of nacrite, clavite, and kaolinite. The X-ray powder data are tabulated.

R. A. H.

ENDELL (J.). *Clay minerals in coals and their ashes.* Clay Min. Bull., 1955, **2**, 289–293.

Clays recovered from bituminous coals by heavy-liquid separation and freed from iron oxides by HCl treatment consist largely of illite and kaolinite. Ash prepared by heating coal to 850°C still gives the X-ray pattern of illite, but the kaolinite pattern disappears above 450°C. The reactions between the various components in the burning of coal and the effect of clays on slags are discussed.

R. C. M.

Applied

BASSETT (W. A.). *Copper vermiculites from Northern Rhodesia.* Amer. Min., 1958, **43**, 1112–1133, 11 figs., 5 tables.

Micaceous ore material from the copper belt of Northern Rhodesia ranges from 2 to 7% Cu. X-ray, chemical, and thermal studies prove the chief Cu-mineral to be vermiculite, with Cu in the interlayer base exchange position; varying amounts of chlorite were admixed. X-ray applications using diffractometer peak heights and spacings, stepwise heating during analyses, and comparison of vermiculite diffraction diagrams following base exchange are the techniques used. Standard d.t.a. runs were made and the weight loss on heating studied. No simple base exchange procedure was found to release the copper from either natural or synthetic samples.

B. H. B.

GONZÁLEZ GARCÍA (F.) & PANEQUE GUERRERO (G.). *Composición mineralógica y génesis de algunos tipos de suelos calizos béticos. II. Estudio fisicoquímico y mineralógico de las fracciones finas (arcillas).* An. Edaf. Fisiol. Veg., 1957, **16**, 1115–1176, 16 figs., 20 tables.

The clay fractions of the soils of Ecija (Seville) are formed essentially of an illitic clay material in a state of alteration or transformation, representing an intermediate form between illite and swelling minerals of the mont-

morillonite group. This was deduced from hydration measurements, d.t.a., and X-ray diffraction study. The clay mineral is not a mixed layer mica-montmorillonite or analogue; it can be placed in the Brown classification scheme for the mica-montmorillonite minerals, at the level of Al-illidromica. It is suggested that minerals of this type may exist without interstratification. [M.A. 13–443]

M. F.-A.

GRÚA MESTRE (A.), COSTELL LANDETE (F.), & FERNÁNDEZ ALONSO (J. I.). *Estudio fisicoquímico de arcillas del Levante español. V. Ensayos técnicos.* An. Edaf. Fisiol. Veg., 1957, **16**, 1177–1195, 24 figs.

In this paper are given the technical results on samples of clays described in earlier papers (An. Edaf. Fisiol. Veg., 1952, **11**, 373; 1953, **12**, 1), and on new clays whose chemical and rational analyses are included. The tests carried out are plasticity, drying, capillarity, contraction to drying, and dehydration.

M. F.-A.

LJUNGREN (P.). *A mineralogical examination of some soil samples from southern and central Honduras.* Fysiograf. Sällsk. Förh. Lund, 1958, **28**, 125–131, 2 figs.

Six soil samples from two different regions in Honduras are examined by d.t.a., X-ray analysis, and optical methods. According to the presence or absence of hydrous alumina the samples are divided into two regional groups. The hydrous alumina minerals occur in the lowland soils of southern Honduras. The author suggests that the regional classification will perhaps result in the discovery of new areas of exploitable bauxites.

E. Å-n.

GRIM (R. E.) & CUTHLBERT (F. L.). *Some clay-water properties of certain clay minerals.* Journ. Amer. Ceram. Soc., 1945, **28**, 90–95.

Plasticity of clays is related to rigidity of the water held on the surfaces of the clay minerals. Applications of the concept in fields of geology, ceramics, and soil mechanics are suggested.

W. A. Wh.

GRIM (R. E.). *Some fundamental factors influencing the properties of soil materials.* Proc. Second Intern. Conf. Soil Mechanics & Foundation Engineering, 1948, **3**, 8–12.

A theory of the structure of soil materials in the plastic state is presented that is based on the oriented configuration of the water molecules initially adsorbed by the clay mineral components. It is shown that the plastic properties may vary greatly because of the presence of small amounts of certain chemical components, and an explanation is offered based on the effect of such components on the orientation of the water molecules. Relatively small

amounts of montmorillonite may cause a relatively great increase in the plastic properties of soil materials. Certain kinds of organic molecules and some clay minerals may form gels. Such components probably explain the unusual and extreme properties in some peculiar soil materials.

W. A. Wh.

GRIM (R. E.) & CUTHBERT (F. L.). *The bonding action of clays. Part I. Clays in green molding sands.* Illinois State Geol. Survey, 1945, Rept. Invest., **102**, 55 pp., 20 figs., 8 tables.

Bonding-clay mixtures were made with kaolinite, halloysite, illite, and montmorillonite. The bonding action of clay in molding sands is thought to be due to a 'wedge block' action, a theory that explains air-set strength developed in kaolinite or halloysite clays.

W. A. Wh.

GRIM (R. E.) & CUTHBERT (F. L.). *The bonding action of clays. Part II. Clays in dry molding sands.* Illinois State Geol. Survey, 1946, Rept. Invest., **110**, 36 pp.

Presents data showing the relation of dry compression strength to amount of tempering water for varying amounts of each type of clay; discusses theory of dry strength based on 'wedge-block' concept; describes air-set strength developed by halloysite and kaolinite clays. W. A. Wh.

GRIM (R. E.). *Relation of clay mineralogy to origin and recovery of petroleum.* Bull. Amer. Assoc. Petrol. Geol., 1947, **31**, 1491-1499.

The relation of various clay minerals to organic material in argillaceous sediments is discussed in the light of evidence which suggests that certain clay minerals under certain conditions are the key factor in the transition of organic matter to petroleum. The properties of clay minerals are considered as a basis for analyzing the effect of water with dissolved electrolytes moving through a sand, or any clay in sand. The characteristics of the clay minerals are believed to be significant factors in the recovery of oil.

W. A. Wh.

PASK (J. A.). *Clays and clay mineralogy.* Calif. Journ. Mines & Geol., 1956, **52**, 113-123.

This review of the structure, ceramic properties, and classification of the clay minerals serves as an introduction to a symposium dealing with various other aspects of the clay minerals [ten following abstracts].

KNAPP (W. J.). *Properties of clays.* Ibid., 125-130.

A limited review dealing mainly with the plasticity of clay-water mixtures.

WISSELER (E. H.) & TURNER (M. D.). *Mineral exploration and winning of clays.* Ibid., 131-144.

BRANDT (W. O.). *Clay testing.* Ibid., 145-150.

The testing refers to clays having industrial applications.

LOHMAN (L. H.). *Testing of clays.* Ibid., 151-154.

PASK (J. A.). *Soluble salt deposits on clay wares.* Ibid., 155-165.

A bibliography of 148 titles follows a description of the nature of soluble salts, preventives, and remedies.

SUTHERLAND (CLARE). *Clay preparation and stiffening methods.* Ibid., 167-175.

HURSH (R. K.). *The drying of clay products.* Ibid., 177-189.

Mainly dealing with the moisture capacity of air and the results of drying tests with relation to industrial clay products.

HURSH (R. K.). *The firing process.* Ibid., 193-206.

HALL (J. L.). *Temperature measurement in kilns.* Ibid., 207-217.

BROGIE (R. I.). *Pyrometry.* Ibid., 219-227. K. S.

MANZ (OSCAR E.). *Investigation of Lake Agassiz clay deposits.* North Dakota Geol. Survey, 1956, Rept. Invest., **27**, 37 pp.

Report evaluates the clays as to their possible ceramic use. D.t.a. reveals presence of montmorillonite.

R. A. Hp.

MANZ (OSCAR E.). *Investigation of lightweight aggregate possibilities of some North Dakota shales.* North Dakota Geol. Survey, 1954, Rept. Invest., **17**, 51 pp.

Describes preliminary tests on deposits of lower grade clays and shales. Sample locations are described and d.t.a. results are presented. Montmorillonite is the only clay mineral reported.

R. A. Hp.

PLUMMER (NORMAN) & HLADIK (WILLIAM B.). *The manufacture of ceramic railroad ballast and constructional aggregates from Kansas clays and silts.* Bull. Kansas Geol. Survey, 1948, **76**, 53-112, 1 fig., 8 pls.

Silt, clay, and shale samples of Pleistocene, Cretaceous Permian, and Pennsylvanian age were tested for use as ceramic slag. The Pleistocene clays contain high silica, low alumina, and low alkalies and alkaline earth oxides. Permian clays are low in both SiO_2 and Al_2O_3 , and high in fluxes, particularly MgO . The clay content of the Pennsylvanian shales is chiefly illite. The Cretaceous Dakota clays are dominantly kaolinite and quartz, with some illite. Products in the ceramic slag from these materials are quartz, tridymite, mullite, leucite, fayalite, and glass. Nineteen chem. anal.

A. Sw.

PLUMMER (NORMAN) & ROMARY (JOHN F.). *Kansas clay-Dakota formation.* Bull. Kansas Geol. Survey, 1947, **67**, 1-241, 17 figs., 7 pls.

The clay mineral content of the Dakota formation in

orth-central, central, and southwestern Kansas is dominantly kaolinite, and the clays are noncalcareous. Ceramic tests and 58 chemical analyses indicate that the whitening to buff-firing clays may be classed as kaolin, ball clay, plastic fire clay, siliceous fire clay, or highly siliceous fire clay. Dark buff-firing and red-firing clays contain iron free iron oxide and some illite (8 chem. anal.). The clays of the underlying Kiowa shale and overlying Graneros shale are illitic and in part montmorillonitic; 7 chem. anal.

A. Sw.

LUMMER (NORMAN), SWINEFORD (ADA), RUNNELS (RUSSELL T.), & SCHLEICHER (JOHN A.). *Chemical, petrographic, and ceramic properties of four clays from the Dakota formation in Kansas.* Bull. Kansas Geol. Survey, 1954, **109**, 153-216, 17 figs., 3 pls.

A. Sw.

CRYSTAL STRUCTURE

CHNEER (CECIL J.). *A modified Hull-Davey chart for high values of c/a.* Amer. Min., 1957, **42**, 282-285, 2 figs.

Published charts of the Hull-Davey type extend only to $c/a \approx 5.4$. A new chart has been constructed for trigonal and hexagonal spacings covering c/a ratios from 3 to 18; this corresponds to unit cell heights in close-packed structures of 4 to 21 layers. Examples are given for powder patterns of three compounds which are chemically distinct but structurally uniform.

R. A. H.

БОКУ (Г. Б.) & БАЦАНОВ (С. С.)] Бокий (Г. Б.) и Бацанов (С. С.). К вопросу о зависимости энергии связи от степени ее ионности. [The dependence of bond energy on the degree of ionic bond.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, ser. 2, **87**, 223-224, 3 figs.

It is shown that the electrostatic energy, the degree of polarization and the energy of the chemical bond are connected by specific function with the degree of ionic bond in crystals. The relation between structural types of crystals and the value of electronegativity is also discussed.

S. I. T.

БЕЛОВ (Н. В.)] Белов (Н. В.). Очерки по структурной минералогии. [Outlines of structural mineralogy.] Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, **8**, no. 11, 3-21, 26 figs.

Topics discussed are: hypomorphy, proper symmetry of atoms, $[\text{Si}_2\text{O}_5]_{\infty}$ bands, carbonate-apatites, structure of various minerals, the proper representation of the unit cell.

S. I. T.

Four clays were studied by chemical and spectrographic analysis, X-ray diffraction, electron and light microscopy, differential thermal analysis, mechanical analysis, and specific surface measurements. The chemical and physical properties are compared with pH, apparent viscosity, and the results of empirical ceramic tests, including water of plasticity, shrinkage water, pore water, volume and linear shrinkage, fired color, pyrometric cone equivalent, saturation coefficient, apparent porosity, apparent and bulk specific gravity, and hardness at various fired temperatures. Minerals reported include kaolinite, fireclay mineral, illite, mixed-layer clay, montmorillonite, chlorite, quartz, muscovite, feldspar, zircon, tourmaline, anatase, and pyrite. Sixteen chem. anal., 8 spectr. anal., 20 X-ray diffractometer traces, 14 d.t.a.

A. Sw.

[ШАФРАНОВСКИЙ (И. И.)] Шафрановский (И. И.). Формы кристаллов. [The forms of crystals.] Труды Инст. Кристалл. Акад. Наук СССР [Trans. Inst. Cryst. Acad. Sci. U.S.S.R.], 1948, no. **4**, 13-166, 12 figs.

This is a treatise on crystal morphology based entirely on geometrical concepts of space lattices, point groups, and space groups. In the first part of this work, 47 simple geometrical forms, 146 crystallographical varieties, and 1403 structural varieties, are tabulated and considered. Crystals of certain minerals are also discussed in the light of geometrical postulates and statistical data. In the second part the principal and the secondary forms of crystals are discussed on the basis of Donnay and Harker principles; calculated values are compared with observed data and lack of agreement in certain cases is explained as the effect of additional factors.

S. I. T.

[ШАФРАНОВСКИЙ (И. И.)] Шафрановский (И. И.). Развитие учения о формах кристаллов. [The development of the study of forms of crystals.] Кристаллография [Crystallography], 1957, **2**, no. 3, 326-233, 8 figs.

This is a brief survey of the recent work on crystal morphology done in the U.S.S.R. and elsewhere. Simple forms, crystallographical and structural varieties, edge forms, antisymmetry, and homology are discussed.

S. I. T.

WHELAN (M. J.) & HIRSCH (P. B.). *Electron diffraction from crystals containing stacking faults. I.* Phil. Mag., 1957, Ser. 8, **2**, 1121-1142, 8 figs. *II.* Ibid., 1303-1324, 8 figs.

R. A. H.

CATICHA-ELLIS (S.) & COCHRAN (W.). *The X-ray diffraction spikes of diamond.* Acta Cryst., 1958, **11**, 245-249.

The theory of the anomalous X-ray reflections from certain diamonds is worked out on the assumption that they are produced by the random occurrence of an abnormal spacing in the [100] direction. The calculated and observed results are in fair agreement.

R. A. H.

PABST (A.). *Transformation of indices in twin gliding.* Bull. Geol. Soc. Amer., 1955, **66**, 897-912, 9 figs.

For computation transformation of indices attending twin gliding is expressed most conveniently by a matrix comparable with the matrices used in connection with changes in the axes of reference. Transformation of crystal forms, of the lattice, and of the crystal structure are illustrated by stereographic projections and diagrams. In twin gliding of gold only simple shear of atom centres is involved ; in sphalerite ZnS slices are affected. [M.A. **12**-385, 590]

R. A. H.

RAMAN (Sir C. V.). *The diffraction of X-rays by diamond.* Part I. Proc. Indian Acad. Sci., 1958, **47**, A, 263-275.

The theory of X-ray diffraction in crystals is discussed and it is shown that the X-ray reflections must be regarded as a cooperative effort of the entire structure in which the nuclei as well as the electrons play their respective roles. The passage of X-rays through a crystal may give rise to vibrational modes which can result in periodic displacement of the stratification of electron density, giving rise to reflections whose frequencies differ from the frequency of the incident X-radiation. Such reflections can appear even when the crystal setting is different from that required for the usual or unmodified reflections ; the geometry of the X-ray reflections in displaced positions is discussed.

R. A. H.

CHURCHMAN (A. T.), GEACH (G. A.), & WINTON (J.). *Deformation twinning in materials of the A4 (diamond) crystal structure.* Proc. Roy. Soc., 1956, **238**, A, 194-203, 8 figs.

Deformation under certain conditions causes {111} twinning in sphalerite. In material beneath hardness impressions formed at elevated temperatures a flow stress is superimposed upon hydrostatic compression ; under these circumstances deformation twins form at temperatures between 0.43 and 0.74 of the absolute melting point. The twinning elements for {111} deformation twins are a translational shear of 0.4084a in the [112] direction with (110) as the shear plane.

R. A. H.

BULLOUGH (R.). *Deformation twinning in the diamond structure.* Proc. Roy. Soc., 1957, **241**, A, 568-577, 1 fig.

The theory of surface dislocations is used to calculate the most likely deformation twinning plane in the diamond

structure. The treatment indicates that deformation twinning ought to occur on {123} as has been reported [See foregoing abstract.]

R. A. H.

MATAYAMA (EITARO). *Structure of Kish and other graphites.* Nature, 1959, **183**, 670-671, 1 fig.

The intensity distribution in reciprocal space derived from the powder line 112̄2 of Kish graphite from the Kamaishi mine, Japan, agrees closely with the theoretical curves.

C. H. K.

SHERRY (P. B.) & COULSON (C. A.). *The vibrational frequency distribution of graphite : I. Out-of-plane modes of single layer.* Proc. Phys. Soc., 1956, **69**, B, 1326-1330, 4 figs.

Using a potential energy function derived from molecular spectra to describe out-of-plane vibrations of a graphite crystal, the distribution function for these variations is calculated for an infinite single layer. Differences between this function and other calculated distributions are examined and the contribution of these modes of vibration to the specific heat of graphite is discussed.

R. A. H.

YAMAZAKI (MASATOSHI). *Electronic band structure of graphite.* Journ. Chem. Physics, 1957, **26**, 930-934.

R. A. H.

WATTS (H.). *Etch pits on calcite cleavage faces.* Nature, 1959, **183**, 314, 1 fig.

Etch pits with three, four, or five sides occur singly, in small groups, or in lines. Groups form at regions of high disorder, and lines along dislocations.

C. H. K.

WHITE (JOE L.). *Reactions with molten salts with layer lattice silicates.* Nature, 1954, **174**, 799-800.

The reaction of molten lithium nitrate with muscovite of less than 5 μ equivalent spherical diameter has been studied. A large portion of the potassium in the mica is replaced by lithium. When saturated with barium and glycerol-solvated the material gives a basal spacing of 17.8 Å, corresponding to that of glycerol montmorillonoids. It is suggested that the lithium enters the layers, reducing the charge on them and thus renders the material expandable. Other dioctahedral micas react similarly but a trioctahedral one, biotite is not expanded.

C. H. K.

OWSTON (P. G.). *The structure of ice-I, as determined by X-ray and neutron diffraction analysis.* Advances in Physics, 1958, **7**, 171-188, 11 figs.

BLACKMAN (M.) & LISGARTEN (W. D.). *Electron diffraction investigations into the cubic and other structural forms of ice.* Advances in Physics, 1958, **7**, 189-198, 7 figs.

R. A. H.

BEST (A.). *The structure of leached gillespite, a sheet silicate.* Amer. Min., 1958, **43**, 970–980, 9 figs.

Gillespite, a tetragonal sheet silicate, $\text{BaFeSi}_4\text{O}_{10}$, can be leached by HCl leaving flakes of hydrated silica. By means of X-ray precession patterns it is shown that these flakes retain the chief features of the sheet structure. The gradual destruction of this structure which attends dehydration by heating, and final recrystallization to an unorientated aggregate of cristobalite, has been followed by X-ray diffraction observations.

J. Ph.

IMONOV (V. I.) & BELOV (N. V.) Симонов (В. И.) и Белов (Н. В.). Кристаллическая структура амблигонита. [*The crystal structure of amblygonite.*] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **119**, 354–356, 3 figs.

The unit cell parameters of amblygonite, in the setting of éléné, are taken as $a = 5.06$, $b = 5.15$, $c = 7.08 \text{ \AA}$. The geometrical analysis of the structure, as based on Patterson and electron density projections, suggests placing Li atoms inside two irregular tetrahedrons forming jointly a polyhedron. The Li-polyhedra alternating with P-tetrahedra form chains stretching parallel to chains of Al-octahedra linked by (F,OH) anions. Calculated positions of atoms and interatomic distances are given.

S. I. T.

ROSS (VIRGINIA). *Geochemistry, crystal structure and mineralogy of the sulphides.* Econ. Geol., 1957, **52**, 755–774.

The principal component metals of the sulphides and the similarities of chemical bonding and packing geometry of both simple and complex sulphides and sulpho-salts are discussed. There is sufficient structural resemblance between the sulphides and sulpho-salts of various chemical compositions to allow a structural classification into two groups on the basis of cubic- or hexagonal-close packing of the atoms; further subdivision is according to a limited number of basic structures; a few miscellaneous structures are unique. An attempt is made to relate the physical and chemical properties of the minerals to the new classification and bonding structure. [M.A. 9-42, 10-331, 12-346]

R. A. H.

OUŠKA (VLADIMÍR). *Změna mřízkové konstanty Hg tetrahedritů vlivem různého chemického složení.* [*The change of the lattice constant of Hg tetrahedrites with different chemical composition.*] Rozpravy Československé Akad., 1956, **66**, no. 13, 1–30, 2 figs., 7 lists of numerical data. (Russian and English summaries).

Mercuriferous tetrahedrites from Rožňava, Poráč and obšiná in Slovakia, Schwaz in Tyrol, and Maškara in Bosnia have been investigated by the Debye-Scherrer method. Higher contents of mercury enlarge the lattice

constant a , if the influence of Hg is not compensated by a higher content of As instead of Sb. Numerous spectral analyses have been made of the named occurrences of Hg tetrahedrites and those from other localities in the Slovakian Ore Mts. In the Hg tetrahedrite from Rudobánya (Hungary) traces of indium have been ascertained. F. S.

[RUMANOVA (I. M.) & VOLODINA (G. F.)] Руманова (И. М.) и Володина (Г. Ф.). Кристаллическая структура натрохальцита, $\text{NaCu}_2\text{OH}(\text{SO}_4)_2 \cdot \text{H}_2\text{O} = \text{Na}(\text{SO}_4)_2(\text{Cu}_2\text{OH} \cdot \text{H}_2\text{O})$. [*The crystal structure of natrochalcite.*] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **123**, 78–81, 2 figs.

The parameters of the unit cell of natrochalcite are $a = 8.75$, $b = 6.16$, $c = 7.44 \text{ \AA}$, $\beta = 118^\circ 40'$, space group $C2/m = C_{2h}^2$. The fine structure is characterized by Cu atoms placed inside distorted O-octahedra and S atoms inside almost regular O-tetrahedra. The Cu-octahedra form chains parallel to b and these chains, linked by S-tetrahedra, form layers parallel to (001). Na atoms, co-ordinated by 8 O atoms are placed between these layers. This explains the perfect cleavage along (001).

S. I. T.

COHEN (ALVIN J.) & SUMNER (G. GARDNER). *Relationships among impurity contents, color centers and lattice constants in quartz.* Amer. Min., 1958, **43**, 58–68, 1 fig.

The lattice constants of four specimens of synthetic and seven of natural quartz have been measured to $\pm 0.0002 \text{ \AA}$ from photographic powder diffraction patterns. The a axis appears the more sensitive to impurity content. A. P.

DOUGLASS (ROBERT M.). *The crystal structure of sanbornite, BaSi_2O_5 .* Amer. Min., 1958, **43**, 517–536, 5 figs.

Sanbornite, previously described as triclinic, is orthorhombic, space group $Pcmn$. The unit cell, $a = 4.63$, $b = 7.69$, $c = 13.53 \text{ \AA}$, contains 4 BaSi_2O_5 . A structure with 13 parameters has been found, yielding an overall residual factor R of 0.10. It is a silicate sheet structure with two $(\text{Si}_4\text{O}_{10})^{4-}$ sheets per unit cell lying parallel to (001) at $z = 1/4$ and $3/4$, and two barium ions lying roughly half way between the successive sheets. Each sheet consists of continuously linked, distorted, six-membered rings of SiO_4 tetrahedra. Unshared vertices of tetrahedra lie on both sides of each sheet. Each barium is surrounded by seven near oxygens. Interionic distances are of expected magnitude. A. P.

KEITH (M. L.) & ROY (RUSTUM). *Structural relations among double dioxides of trivalent elements.* Amer. Min., 1954, **39**, 1–23.

Compounds were prepared from equimolar and 3:5 molar ratio mixtures of oxides $A_2\text{O}_3$ and $B_2\text{O}_3$ with trivalent rare-earth A ions and B ions Al, Ga, Cr, Fe, In, Sc. The structure

of the products in each case was identified as belonging to one of seven types: perovskite, YCrO_3 , garnet, Ti_2O_3 , La_2O_3 , corundum, and $\beta\text{Ga}_2\text{O}_3$. The effect of ionic radius ratio and cation charge on structure is discussed. Cell parameters are given for perovskite type structures and powder data presented for garnet- and YCrO_3 -type compounds, and for two borates. High and low temperature forms were investigated, and in some cases dielectric constants were determined. [M.A. 10-20, 11-364] J. Z.

[SIMONOV (V. I.) & BELOV (N. V.)] Симонов (В. И.) и Белов (Н. В.). Кристаллическая структура сейдозерита. [*Crystalline structure of seidozerite.*] Доклады Акад. Hayk CCCP [C.R. Acad. Sci. U.S.S.R.], 1958, **122**, 473-476, 2 figs.

According to the X-ray data the crystallochemical formula of seidozerite [M.A. 14-198; A.M. 44-467] is $\text{Na}_2(\text{Mn}_{0.50}, \text{Ti}_{0.75}, \text{Zr}_{0.75})\text{Si}_2\text{O}_8(\text{F}, \text{OH})$. The structure of seidozerite is characterized by solid walls made of Mn, Ti, and Na oxygen octahedra, threaded along two-fold axes and parallel to ($x0y$) and placed at $c/2$ distance from each other. These walls are linked by bands made of alternating Zr as Na oxygen octahedra stretching parallel to the b -axis. Three O—O edges of the $[\text{Si}_2\text{O}_7]$ group form the edges of three Na oxygen octahedra. S. I. T.

FISHER (D. J.). *Note on lithiophosphate.* Amer. Min., 1958, **43**, 761-762, 1 table.

Powder diffraction data are given for synthetic Li_3PO_4 . The pattern agrees well with that by A. P. Denisov. [A.M. 42-585]

B. H. B.

CARRON (M. K.), MROSE (MARY E.), & MURATA (K. J.). *Relation of ionic radius to structures of rare-earth phosphates, arsenates, and vanadates.* Amer. Min., 1958, **43**, 985-989.

Phosphates, arsenates, and vanadates of the rare-earths and of La, Sc, and Y were prepared by wet chemical methods and found by X-ray powder diffraction patterns to be isostructural either with monazite or xenotime. The phases with larger cations have monazite structure; these include phosphates from La (radius 1.14 Å) to Gd (0.97), arsenates from La to Nd (1.04), and the vanadate of La. All the phases with smaller cations have xenotime structure.

A. P.

GOLDSMITH (JULIAN R.) & GRAF (DONALD L.). *Relation between lattice constants and composition of the Ca-Mg carbonates.* Amer. Min., 1958, **43**, 84-101, 4 figs.

Synthetic magnesian calcites containing 4.94, 9.89, 14.83, and 19.78 mol per cent MgCO_3 in solid solution were prepared by solid-state reaction. Dolomite crystals from five

localities were analyzed by wet methods and gave molar compositions ranging from $\text{Ca}_{0.4940}(\text{Mg}, \text{Fe}, \text{Mn})_{0.5060}$ to $\text{Ca}_{0.5063}(\text{Mg}, \text{Fe}, \text{Mn})_{0.4937}$. Values of a and c for magnesian calcites, the dolomites, and a synthetic magnesite were obtained from X-ray diffractometer and film measurements. The synthetic magnesite has a 4.6330 Å, c 15.016. The average a for the dolomites is 0.092 per cent less than one half the sum of the a values for calcite and magnesite, and the average c value is 0.21 per cent less than the analogous hypothetical c value. If the magnesian calcite curves are extrapolated to 50 mol per cent MgCO_3 , the comparable numbers are 0.98 per cent for a and 0.44 per cent for c .

A. P.

KOHN (J. A.), KATZ (GERALD), & BRODER (J. D.). *Characterization of $\beta\text{-Ga}_2\text{O}_3$ and its alumina isomorph $\theta\text{-Al}_2\text{O}_3$.* Amer. Min., 1957, **42**, 398-407, 3 figs.

Lath-shaped crystals of $\beta\text{-Ga}_2\text{O}_3$, which is isostructural and forms a complete solid solution series with $\theta\text{-Al}_2\text{O}_3$, have been grown from the vapour phase. All crystals examined were multiply twinned on (001) giving an apparent orthorhombic symmetry; the true cell is monoclinic a 5.04, b 3.04, c 12.23 Å, β 103° 42', $Z=4$, space group $A2/m$. The cell dimensions of $\theta\text{-Al}_2\text{O}_3$ are contracted with respect to those of its Ga_2O_3 isomorph by approximately 3%. [M.A. 11-237]

R. A. H.

VOGT (THOROLF), BASTIANSEN (OTTO), & SKANCKE (PER). *Holmquistite as a rhombic amphibole.* Amer. Min., 1958, **43**, 981-982.

Holmquistite, hitherto regarded as a lithium glaucophane, is shown by single crystal X-ray diffraction photographs to be an orthorhombic amphibole with cell dimensions a 18.36, b 17.75, and c 5.29 Å, and cell content very close to the ideal $\text{Li}_4\text{Mg}_6\text{Al}_4\text{Si}_{16}\text{O}_{44}(\text{OH})_4$. A. P.

SAKATA (YOSHIO). *Unit cell dimensions of synthetic aluminian diopside.* Japanese Journ. Geol. Geogr., 1957, **28**, 161-168, 2 figs.

Aluminian diopsides containing up to 20% $\text{CaAl}(\text{AlSi})\text{O}_6$ in solid solution were synthesized at 1200°C and their unit cell dimensions measured. Parameters a , b , and β decrease linearly while c increases with the amount of Al ion substituting for both Si and Mg. Pure synthetic diopside had a 9.743, b 8.923, c 5.251 Å, β 74° 04'; synthetic material with 20% $\text{CaAl}(\text{AlSi})\text{O}_6$ had a 9.712, b 8.867, c 5.266 Å, β 73° 51'. From mixtures with higher contents of $\text{CaAl}_2\text{SiO}_6$ aluminian diopsides probably containing up to about 40% of this component were formed (a 9.678, b 8.807, c 5.280 Å, β 73° 49') together with a little melilite and anorthite. [M.M. 30-218; M.A. 11-92, 145, 12-334, 13-531, 533]

R. A. H.

URILENKO (K. I.)] Куриленко (К. И.). Удельный вес турмалинов и их изменение при нагревании до 1350° С. *Densité des tourmalines et leur transformation au cours du chauffage jusqu'à 1350°C.* Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, **11**, 69–80, 6 figs. (Russian with French summary.)

In tourmalines the real specific gravity is higher than the calculated from the X-ray data. This suggests that tourmalines have a 'porous structure,' which is revealed when they are heated up to 1350°C. A detailed discussion of the structure of tourmalines, and their behaviour on heating, is given.

S. I. T.

MA-DE-FARIA (J.). *Heat treatment of metamict euxenites, polymignites, yttrontantalites, samarskites, pyrochlores, and allanites.* Min. Mag., 1958, **31**, 937–942.

The standard thermal treatments earlier proposed have been applied to a range of metamict niobotantalates. A face-centred cubic phase is formed at 700°C, and at 1000°C a more characteristic phase appears combined with the cubic one. When the same treatment was applied to lanite only a slight formation or strengthening of the original structure appeared at 700°C, and at 1000°C a cubic phase was formed together with other phases. X-ray diffraction powder data are tabulated for polymignite from Fredriksværn, Norway; euxenites from south Norway and Ontario (for cubic phase $a = 5.07 \text{ \AA}$); yttrontantalite from Älterby, Sweden ($a = 10.28 \text{ \AA}$), pyrochlore from Langsundord, Norway ($a = 10.38 \text{ \AA}$); and allanite from Greenland ($a = 5.44 \text{ \AA}$); samarskite had $a = 5.16 \text{ \AA}$. [M.A. **12**–173, **13**–260]

R. A. H.

DAVIS (R. J.). *Mordenite, ptilolite, flokite, and arduinite.* Min. Mag., 1958, **31**, 887–888.

Examination of material from the type localities for mordenite, ptilolite, flokite, and arduinite has given X-ray powder photographs identical as to line position and showing no significant variation in line intensities. These minerals are all considered to be mordenite, with a unit cell volume of $2800 \pm 10 \text{ \AA}^3$; the constancy of cell parameters is contrasted with the variable compositions reported and is taken to support the concept of a structure based on a rigid $\text{Si}_4\text{Al}_4\text{O}_{16}$ framework. [M.M. **23**–559, **25**–212; M.A. **23**–59, **11**–293, **12**–486]

R. A. H.

MAMEDOV (Kh. S.) & BELOV (N. V.)] Мамедов (Х. С.) и Белов (Н. В.). Кристаллическая структура фошагита $\text{Ca}_8[\text{Si}_6\text{O}_{17}](\text{OH})_6$. [*The crystalline structure of foshagite $\text{Ca}_8(\text{Si}_6\text{O}_{17})(\text{OH})_6$.*] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **121**, 901–903, 4 figs.

In a previous work the authors [M.A. **13**–420] have shown that if we refer foshagite to the wollastonite unit cell we

shall get two extra units of $\text{Ca}(\text{OH})_2$. Differing from the interpretation by J. A. Gard and H. F. W. Taylor [A.M. **43**–1; M.A. **14**–197] the authors would prefer to postulate foshagite as a lime xonotlite, $\text{Ca}_8(\text{Si}_3\text{O}_{17})(\text{OH})_6$. Like other hydrous lime silicates, foshagite is made of Ca-octahedra chains linked to $[\text{Si}_3\text{O}_4]_{\infty}$ chains. This structure is also in agreement with the thermal behaviour of foshagite.

S. I. T.

[MAMEDOV (Kh. S.) & BELOV (N. V.)] Мамедов (Х. С.) и Белов (Н. В.). О кристаллической структуре гиллебрандита. [*On the crystal structure of hillebrandite.*] Доклады Акад. Наук. СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **123**, 741–743, 1 fig.

A recalculation suggests that the unit cell of hillebrandite may be considered to contain alternating layers of xonotlite and portlandite sharing between them the Ca atoms. This structure explains the intergrowth of hillebrandite with portlandite and the prevailing cleavage of hillebrandite along the (001) plane.

S. I. T.

[MAMEDOV (Kh. S.) & BELOV (N. V.)] Мамедов (Х. С.) и Белов (Н. В.). О кристаллической структуре тоберморита (тоберморитов). [*On the crystal structure of tobermorite (tobermorites).*] Доклады Акад. Наук. СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **123**, 163–165, 2 figs.

The fundamental pattern of the structure of tobermorite is provided by crenulated layers made of xonotlite rings $[\text{Si}_6\text{O}_{12}]_{\infty}$ and its general formula is $2\{\text{Ca}_{10}(\text{Si}_{12}\text{O}_{31})(\text{OH})_6\} \cdot n\text{H}_2\text{O}$, with $n = 6$ to 18. Tobermorite from Loch Eynort [M.M. **31**–361] differs from normal tobermorites by having $a = 10 \text{ \AA}$ instead of 16.5 \AA . Its a and b parameters are equal to those of xonotlite while c is three times longer and its formula is $\text{Ca}_4\text{Ca}_6(\text{Si}_6\text{O}_{12})_2 \cdot 10 \text{ H}_2\text{O}$. One can visualise it as a three-layered xonotlite which lost one $\text{Ca}(\text{OH})_2$ and gained five H_2O , in other words it is an intermediate member situated between normal tobermorite and xonotlite.

S. I. T.

[MAMEDOV (Kh. S.) & BELOV (N. V.)] Мамедов (Х. С.) и Белов (Н. В.). Кристаллическая структура слюдо-подобных Ca-гидросиликатов: окснита, некоита, трускоттита, гиролита. Новый кремнекислородный радикал $[\text{Si}_6\text{O}_{15}]_{\infty}$. [*The crystal structure of micaceous Ca-hydrosilicates: okenite, nekoite, truscottite, gyrolite. A new silico-oxygen radical $[\text{Si}_6\text{O}_{15}]_{\infty}$.*] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **121**, 720–723, 4 figs.

The authors assume the fundamental pattern of the structure of wollastonite, xonotlite, and related minerals to be made of alternating layers: one layer made of Ca-octahedra columns arranged with their O—O edges in continuity, and the other made of octagons and pentagons of

Si-tetrahedra of $[Si_6O_{15}]$ —composition. If all octahedra of xonotlite ring are occupied by Ca atoms then the ratio Ca : Si will be equal to 4 : 6, as in gyrolite, $24[Ca_4Si_6O_{15}]$ $(OH)_2 \cdot 4H_2O$, pseudohexagonal, a 9.72, c $6 \times 22.13 \text{ \AA}$. If $\frac{2}{3}$ of the octahedra are occupied by Ca atoms, then the ratio Ca : Si will equal 3 : 6, corresponding to truscottite $4[Ca_3Si_6O_{15}] \cdot 2H_2O$, pseudohexagonal, a 9.72, c 18.71, okenite $3[Ca_3Si_6O_{15} \cdot 2H_2O \cdot 0.4H_2O]$ triclinic, a 9.84, b 7.20, c 21.33, α 90°, β 103.9°, γ 111.5°, and nekoite $Ca_3Si_6O_{15} \cdot 2H_2O \cdot 0.4H_2O$, triclinic, a 9.86, b 7.32, c 7.60, α 103° 54', β 86° 12', γ 111° 48'.
S. I. T.

ARUJA (E.). *The unit cell of orthorhombic pentacalcium trialuminate, $5CaO \cdot 3Al_2O_3$.* Acta Cryst., 1957, 11, 337-338.

Single crystals were grown from melts, and X-ray measurements gave a 10.975, b 11.250, c 10.284 Å (all $\pm 0.005 \text{ \AA}$) space group $C222_1$, $Z=4$. Optical constants are α 1.682, β 1.682, γ 1.685 (all ± 0.001), α perpendicular to cleavage face (001), γ parallel to a axis. $2V_\alpha = 88.5^\circ \pm 0.8$. A structural resemblance to gehlenite $2CaO \cdot Al_2O_3 \cdot SiO_2$ is suggested by the powder pattern and by certain features of the single crystal Weissenberg photographs. [M.A. 7-235] J. Z.

ECONOMIC MINERALS AND ORE DEPOSITS

BARNES (H. L.) & KULLERUD (GUNNAR). *Relations between composition of ore minerals and ore solutions.* Econ. Geol., 1957, 52, 825-830.

The four independent variables of pressure, temperature, ionic species, and activity coefficients, must be quantitatively evaluated in order to deduce the composition of an ore solution from the composition of precipitated minerals. At present sufficient experimental data for derivation of the required functions are lacking.
R. A. H.

KRAUSKOPF (KONRAD B.). *The heavy metal content of magmatic vapor at 600°C.* Econ. Geol., 1957, 52, 786-807.

To test the feasibility of hypotheses of vapour transport in explanation of ore deposition, an attempt is made to calculate the composition of a vapour phase in equilibrium with a cooling intrusion at 600°C. For most metals the chlorides are the most abundant compounds in the vapour; neither sulphides, oxides, nor native metals would be in sufficient concentration to play a significant part in ore deposition. Many common metals are present in magmatic vapour at 600°C in quantity sufficient to account for the formation of ore deposits. Differences in calculated volatilities provide an explanation for the restriction of Hg and Sb to low-temperature deposits, and for the appearance of Pb later than Zn in zonal and paragenetic sequences.
R. A. H.

MCKINSTRY (H. E.) & KENNEDY (G. C.). *Some suggestions concerning the sequence of certain ore minerals.* Econ. Geol., 1957, 52, 379-390.

The observed sequences in various mining districts are used to deduce probable forms of phase diagrams for those parts of the systems Cu-Fe-S, Fe-O-S, Cu-As-S, Pb-As-S, and Pb-Sb-S in which naturally occurring ore minerals form. The sequence of phases appearing can be explained by assuming an increase in the chemical potential of sulphur in the fluid phase relative to the solid phases when final adjustments in the relations between the solid phases are

taking place. The sequence of phases at a point in a vein is not necessarily the same as the sequence of introduction of the components.
G. D. N.

SULLIVAN (C. J.). *Heat and temperature in ore deposition.* Econ. Geol., 1957, 52, 5-24.

A discussion of the significance of thermal stability ranges of minerals in the solid state in relation to zoning and paragenesis in ore deposits, leads to the view that thermal stability is more important than relative solubilities in aqueous solution in determining sequence of ore deposition. Granitization, metamorphism, and ore formation may be different expressions of reaction and movement of elements in the earth's crust in response, principally, to heat, pressure, temperature, and chemical gradients. The paper is intended to suggest lines of thought along which 'a different approach to the subject of ore deposits could be made'. G. D. N.

GIBLIN (P. E.). *The geology and mineralogy of the Basie Property, Faraday Township.* [M.A.Sc. thesis, Univ. Toronto, 1955, 75 pp., 12 figs. 16 photos.] Abstr. Canad. Mining Journ., 1956, 77, 70.

A calcite mass in Grenville gneiss contains betafite, apatite, zircon, molybdenite, pyrrhotite, fluorite, albite, amphibole, and biotite. Temperatures of filling of fluid inclusions in apatite indicate a minimum temperature of formation of 365°C. The fluids contain $40 \pm 2\%$ by weight NaCl or $54 \pm 5\%$ by weight of KCl.
W. R. G.

MCKINSTRY (HUGH). *Source of iron in pyritized wallrock.* Econ. Geol., 1957, 52, 739-754.

The amounts of iron in fresh rocks and their altered equivalents have been compared by recalculating many published analyses to determine whether or not the iron already present in the rocks is sufficient to account for the pyrite in the altered zone. In the majority of cases the change indicated was within the presumed limits of error.

impling. There are, however, several instances of the addition of significant quantities of iron during alteration as well as examples of at least partial removal; carefully planned sampling from many districts is necessary before trustworthy generalizations about the chemistry of rock alteration are possible.

R. A. H.

SIGHT (C. L.). *Ore-genesis—the source bed concept*. Econ. Geol., 1957, **52**, 808–817.

The source bed concept postulates that sulphide orebodies are mostly derived from sulphides deposited syngenetically in one particular stratigraphical horizon of the sedimentary series concerned, and that the sulphides subsequently migrated differentially under the influence of rise in temperature of the rock environment.

R. A. H.

FTEDAHL (CHR.). *A theory of exhalative-sedimentary ores*. Geol. För. Förh. Stockholm, 1958, **80**, 1–19, 3 figs.

After noting the increasing recognition of welded tuffs and similar acid pyroclastics the author emphasizes the probable importance of a process of ore formation involving the precipitation of metals in volcanic gases escaping from a crystallizing granitic magma chamber into the sea. Gases similar to those known to contain metals in contact pneumatolysis around a granite may, when emitted at the sea bottom, be the source of the orogenic pyrite and magnetite ore beds in the Scandinavian Caledonides, as well as in the Rio Tinto type of deposit. It is argued that the relatively sudden appearance of iron in the sea, precipitating in a suitable chemical environment as sedimentary iron ore beds, is due to its exhalative origin. It is tentatively suggested that some zinc, lead, and copper ores with certain sedimentary features may represent similar precipitations.

R. A. H.

IESE (R. G.). *An occurrence of mineralized organic material in Nova Scotia*. Econ. Geol., 1957, **52**, 76–82.

A small deposit of mineralized organic material is described from the upper Mississippian of Cape George, Nova Scotia. Replacement of cell walls by pyrites and lumens by chalcocite is followed by more complete replacement during which bornite, chalcopyrite, tetrahedrite-tennantite, sphalerite, galena, and covellite develop. The copper sulphides have been partly oxidised to azurite and malachite. It is suggested that the sulphides were deposited either by adsorption or by chemical reaction in a reducing environment created by decaying organic material.

G. D. N.

LEPPER (M. R.) & WYANT (D. G.). *Notes on the geology of uranium*. Bull. U.S. Geol. Survey, 1957, **1046-F**, 87–148.

The geochemistry of uranium and the behaviour of

uranium during orogeny are surveyed from the world literature available by 1954. The review considers the types, size, grade, and distribution of uranium deposits. K. S.

HEINRICH (E. W.M.). *Radioactive pegmatite deposits . . . how to know them*. Canad. Mining Journ., 1956, **77**, 69–72 and 100, 4 figs.

Pegmatites with accessory minerals are in either intrusive or host rock near the margins of batholiths. Unzoned pegmatites may contain disseminated uraninite or uranothorite. Tables show the position of valuable minerals in zoned and complex pegmatites.

W. R. G.

HOUSTON (JOSEPH R.), BATES (ROBERT G.), VELIKANJE (ROBERT S.), & WEDOW (HELMUTH, Jr.). *Reconnaissance for radioactive deposits in southeastern Alaska*, 1952. Bull. U.S. Geol. Survey, 1958, **1058-A**, 1–31.

In the vicinity of Salmon Bay on the northeastern shore of Prince of Wales Island carbonate-hematite veins contain dolomite-ankerite and alkali feldspar with decreasing amounts of hematite, pyrite, siderite, magnetite, quartz, chalcedony, and chlorite, as well as small amounts of parisite, bastnaesite, muscovite, fluorite, apatite, thorite, zircon, monazite, epidote, topaz, garnet, chalcopyrite, and marcasite.

K. S.

TRITES (ALBERT F., Jr.) & THURSTON (RALPH H.). *Geology of Majuba Hill, Pershing County, Nevada*. Bull. U.S. Geol. Survey, 1958, **1046-I**, 183–203.

The principal ore deposits are those of copper (chalcocite, chalcopyrite, and cuprite with azurite, brochantite, malachite, chalcanthite, and chrysocolla), tin (cassiterite), and uranium (metazeunerite). Scorodite, olivenite, chalco-phyllite, and clinoclase [M.A. 10–342] occur locally with oxidized copper minerals.

K. S.

FINNELL (TOMMY L.). *Structural control of uranium ore at the Monument No. 2 mine, Apache County, northeastern Arizona*. Econ. Geol., 1957, **52**, 25–35, 11 figs.

Tuyuyamunite, carnotite, becquerelite, corvusite, hewettite, metahewettite, rauvite, and uraninite occur impregnating sandstone of late Triassic age, filling fractures, and replacing quartz, clay, and fossil plant fragments. The ore-bearing solutions may have risen along strike-slip vertical faults from a deep source, and spread out to deposit ore in the highly permeable brecciated sandstone and conglomerate.

R. A. H.

BOTINELLY (THEODORE) & WEEKS (ALICE D.). *Mineralogic classification of uranium-vanadium deposits of the Colorado Plateau*. Bull. U.S. Geol. Survey, 1957, **1074-A**, 1–5.

The V : U ratio and the valence state of the ore metals permit classification of the ore deposits into eight types. The dominant and minor ore minerals and the gangue minerals are subdivided according to valence state. K. S.

KERR (PAUL F.). *Uranium emplacement in the Colorado Plateau*. Bull. Geol. Soc. America, 1958, **69**, 1075-1112, 34 figs., 3 pls.

Four hypotheses of uranium emplacement on the Colorado Plateau are considered: (1) the hydrothermal, (2) the circulatory groundwater, (3) the ash-leach, and (4) the syn-genetic theories. The time and temperature factors implied by data on absolute age, the wall rock alteration, mineral association, organic-ore emplacement, and breccia pipes and collapse features are discussed. The author concludes that the hydrothermal hypothesis is most plausible in the light of recent evidence, but that subsequent distribution by ground-water and superimposed supergene action must be recognized.

A. L. A.

GOLDSTEIN (E. H.). *Geology of the Dakota formation uraninite deposit near Morrison, Colorado*. Econ. Geol., 1957, **52**, 775-785.

Uraninite is found in a Cretaceous sandstone in close association with asphalt, pyrite, and ilmenite [ilsemannite? M.A. **9**-120, **11**-403], and its occurrence is related to a strike-slip fault. It is suggested that uranium-bearing hydrothermal solutions originating in the pre-Cambrian complex migrated along a thrust fault into minor shear zones; where these traversed permeable sandstone the uranium was precipitated when favourable conditions for deposition, such as the presence of asphalt, were encountered. R. A. H.

SIMS (P. K.), PHAIR (GEORGE), & MOENCH (R. H.). *Geology of the Copper King uranium mine, Larimer County, Colorado*. Bull. U.S. Geol. Survey, 1958, **1032-D**, 171-221.

Pyrometasomatic sulphide-magnetite deposits, consisting of pyrite, sphalerite, chalcopyrite, pyrrhotite, and magnetite, and a vein pitchblende deposit, consisting of pitchblende and associated minerals (uraninite, coffinite, and UO_3 -rich pitchblende) constitute the two types of mineral deposits. Alpha-helium age determinations on the magnetite indicate its late Precambrian age; $^{206}\text{Pb}/^{238}\text{U}$ and $^{207}\text{Pb}/^{235}\text{U}$ age determinations on hard pitchblende from the vein indicate an early Cenozoic age (ranging from 55 to 76 million years). Colored secondary radioactive minerals are absent.

K. S.

CURTISS (ROBERT E.). *A preliminary report on the uranium in South Dakota*. South Dakota Geol. Survey, 1955, Rept. Invest., **79**, 102 pp., 12 figs.

The report is divided into two parts. Part I is concerned with prospecting for uranium and contains a brief discussion of the uranium minerals, their physical properties, and geological occurrence. Part II describes the deposits in the counties in which they have been reported. Each deposit is discussed with respect to history, location, general geology, mineralogy, localization of ores, grade, mining, origin, and future prospecting. Minerals reported are pitchblende, uraninite, rauvite, carnotite, tyuyamunite, metatyuyamunite, metazeunerite, uranocircite, autunite, torbernite, uranophane, becquerelite, gummite, and an unidentified 'organo-uranium complex' mineral. Brief descriptions of their physical properties, mode of occurrence, and mineral associations are given. The minerals occur in veins and pegmatites in igneous and metamorphic rocks, and as crack fillings, grain coatings, impregnations, fossil bone and root replacements in sedimentary rocks. Some uranium is fixed in carbonaceous shales and lignites.

R. A. H.

TOWSE (DONALD). *Uranium deposits in western North Dakota and eastern Montana*. Econ. Geol., 1957, **52**, 904-913, 4 figs.

Bedded and lenticular uranium deposits in both lignite and sandstone beds were concentrated by circulating groundwater. Most of the uranium is in complex carbon-uranium compounds; metatyuyamunite and autunite are common secondary minerals. Ore deposition was controlled by carrier bed permeability, by host-rock petrography, and by structure.

R. A. H.

TSCHANZ (C. M.), LAUB (D. C.), & FULLER (G. W.). *Copper and uranium deposits of the Coyote district, Morenci County, New Mexico*. Bull. U.S. Geol. Survey, 1958, **1030-L**, 343-398.

The principal copper minerals are chalcocite and malachite. Chalcocite replaces wood and forms nodules that contain small, variable amounts of pyrite, bornite, covellite, and, rarely, uraninite. The chief ore minerals in the uranium deposits are metatyuyamunite, an unidentified uraniferous substance, and black micaceous vanadium minerals similar to roscoelite.

K. S.

KELLEY (DANA R.) & KERR (PAUL F.). *Urano-organic ore at Temple Mountain, Utah*. Bull. Geol. Soc. America, 1958, **69**, 701-756, 21 figs., 6 pls.

Urano-organic ore at Temple Mountain, Utah, occurs in the vicinity of highly altered collapse structures associated with carbonaceous and petrolierous materials. Results are given of an investigation of this ore by X-ray diffraction, X-ray spectrographic analysis, microscopic examination, microhardness determination, and d.t.a. Chemically, the ore is similar to low-rank coals, but the geological conditions

anium distribution, texture, physical properties, and microscopical characteristics indicate a genetic relation to neral oil. The ore is considered a uranium analogue, responding to thucholite, resulting from polymerization and oxidation-devolatilization of hydrocarbons on interaction of ore solutions and organic materials at elevated temperatures. The distribution and character of alteration, ore-mineral suite, the postulated temperature, and the essence of collapse structures suggest an epithermal hot-ring origin for the uranium mineralization. Textures suggest that emplacement of the ore occurred when the ganic material was in association with the metallic components or their ore solutions. Metallic elements in the ore, shown by X-ray spectrograph, are in rough zonal relation. The occurrence of native arsenic, $2M_1$ mica clay, large masses of dolomite, and the character of the ore suggest a temperature between 100° and 350°C . A. L. A.

RENGUELLI (J.). *Una visita a la primera mina de minerales de uranio de alta ley explotada en Argentina*. Univ. Nacional Eva Perón, Fac. Ciencias Nat. y Mus., Notas del Mus., 1954, **17**, 329–345, 11 figs.

A description is given of the Santa Brigida uranium mine in the Sañogasta district, La Rioja province. It is located in schistose sediments cut by andesitic and dacitic dykes between two hornblende-granite masses. The uranium occurs chiefly as tyuyamunite, which is associated with monazite, calcite, chalcocite, malachite, azurite, and hematite.

R. A. H.

KOPCHENOVА (E. V.) & SKVORTSOVA (K. V.)] Копченова (Е. В.) и Сквортцова (К. В.). О колломорфном молибдените и урано-молибденовых чернях в месторождениях урана. [On collomorph molybdenite and uranium-molybdenic black oxides in uranium deposits.] Доклады Акад. Наук. СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **123**, 159–162, 2 figs.

The association of collomorph molybdenite and collomorph nasturan suggests that they were precipitated from a melt. Uranium-molybdenite 'black', which X-rays show to be amorphous, often replace collomorph molybdenite. Chemical and spectroscopic analyses of these minerals from unspecified localities are given. A suggestion is made that oxidation of molybdenite and nasturan takes place in two stages.

S. I. T.

VILES (W. J.). *Gold deposits and mines (of the eastern portion of the Hartley gold belt)*. Bull. Geol. Survey Southern Rhodesia, 1957, **44**, pt. 2, 180 pp., 7 figs., 10 pls., 1 map.

Descriptions are given of 359 gold mines or claims including the largest mine in the country, the Cam and Motor, but in 1951 there were only 29 producing mines. Reference is

also made to the occurrence of antimony, chromite, copper, iron, limestone, platinum, silver, and tungsten. The map is the same as that which accompanies part 1. E. D. M.

ANTROBUS (E. S. A.). *The origin of the auriferous reefs of the Witwatersrand System*. Trans. Geol. Soc. South Africa, 1957 (for 1956), **59** 1–22, 5 pls.

The distribution of gold in the Steyn Reef and in the underlying Lower Reef in the Orange Free State supports a detrital origin for the gold.

E. D. M.

CARLSON (D. W.) & CLARK (W. B.). *Lode gold mines of the Alleghany-Downieville area, Sierra County, California*. Calif. Journ. Mines Geol., 1956, **52**, 237–272.

The sequence in stages of mineralization is chlorite, quartz, carbonate, and minor uneconomic sulphides. K. S.

COLEMAN (LESLIE C.). *Mineralogy of the Giant Yellowknife gold mine, Yellowknife, N.W.T.* Econ. Geol., 1957, **52**, 400–425, 18 figs.

The suite of metallic minerals in the extensive shear zone systems on the west shore of Yellowknife Bay, on the north arm of Great Slave Lake, Canada, appears to have been formed during three separate periods of mineralization from hydrothermal solutions having a magmatic origin. Pyrite and arsenopyrite were formed during the first period; sphalerite, chalcopyrite, and pyrrhotite in the second mineralization; during the last period, at temperatures below 350°C and fairly low pressures, the minerals formed included galena, stibnite, gersdorffite, ullmannite, gudmundite, marcasite, sphalerite, pyrrhotite, chalcopyrite, boulangierite, meneghinite, jamesonite, bournonite, tetrahedrite, and berthierite, together with native lead and antimony. Some of the gold may have been deposited in solid solution in pyrite and arsenopyrite; in some cases reaction of antimony-bearing solutions with pre-existing gold has given rise to aurostibite. [M.A. **10**–**217**, **11**–**414**, **12**–**204**] R. A. H.

EL SHAZLY (E. M.) & AFIA (M. S.). *Geology of Samiuki deposit, Eastern Desert*. Egypt. Journ. Geol., 1958, **2**, no. 1, 25–42, 4 figs., 7 pls. Summary in Arabic, ibid., **43**.

The paper deals with the geology, mineralogy, and origin of the complex zinc, copper, lead, and iron sulphide mineralization at Samiuki and Atshan Mines, Eastern Desert, Egypt. Chemical analyses of some grab samples of the ores are given.

E. M. El S.

LITTLE (W. M.). *A study of inclusions in cassiterite and associated minerals*. [Ph.D. Thesis, Univ. Toronto, 1956, 85 pp., 10 tables, 25 figs.]. Abstr. Canad. Mining Journ., 1956, **77**, 69.

Several specimens from pegmatites contain complex inclusions, suggesting deposition from magmas. Other pegmatite specimens and all those from other rocks contain water or water plus CO₂ inclusions, suggesting deposition from dilute solutions. Minimum temperatures of formation range from 244°C to 499°C (corrected for pressure, 300–600°C).

W. R. G.

MONSEUR (G.). *Sur la présence de cassitérite et la paragenèse minérale du gisement de wolfram de Montredon (Tarn, France).* Ann. (Bull.) Soc. géol. Belgique, 1955, **79** (for 1955–56), B103–109, 1 fig.

With the discovery of cassiterite the paragenesis of this deposit is complete. The Montredon deposit is compared with that of Salsigne [following abstract]; the former belongs in the pneumatolytic phase, the latter is extended into the hydrothermal phase.

J. M.

MONSEUR (G.). *Sur la signification de la wolframite dans la mineralisation de la mine de Salsigne (Ande, France).* Ann. (Bull.) Soc. géol. Belgique, 1956, **79** (for 1955–56), B33–39, 1 fig.

Phases of mineralization were successively wolfram, scheelite, mispickel, pyrite, chalcopyrite. The deposit is of the transitional pneumatolytic-hydrothermal type [previous abstract].

J. M.

LEGRAYE (M.) & GOFFINET (A.). *Étude géologique et métallogénique du gisement de wolfram de Montredon-Labessonnie (Tarn, France).* Ann. (Bull.) Soc. géol. Belgique, 1955, **78** (for 1954–55), B203–246, 1 fig., 1 map.

The deposit comprises an assemblage of parallel veins located in metamorphic schists in the vicinity of a nose of granitic gneiss. The geology of the region is described. Petrographical examination is made of a limestone, a quartzose breccia, and two special rocks as well as of the schists and gneiss. The veins and their minerals are then studied; the main mineral is wolfram, with quartz, scheelite, tourmaline, white micas, and some accessory minerals. The origin and paragenesis of the minerals are discussed.

J. M.

Greffroy (J.) & Lafforgue (P.). *Présence de scheelite dans un filon aurifère près d'Ambazac (Haute-Vienne).* Bull. Soc. franç. Min. Crist., 1957, **80**, 401–405, 3 figs.

Scheelite and native gold are recorded, with pyrite, arsenopyrite, sphalerite, chalcopyrite, galena, and a Pb-Sn-sulphide, in an aggregate of quartz, biotite, and calcite, as a metalliferous vein in the metamorphic aureole associated with the batholith of Monts d'Ambazac.

R. A. H.

NEWMAN (Wm. J.). *Mining tungsten deposits by open pit methods pays at Getchell mine.* Engineering Minim. Journ., New York, 1957, **158**, 90–93.

The deposit is a garnet tactite in the Osgood Mountain, Nevada, with quartz, epidote, calcite, chalcopyrite, pyrite, scheelite, and molybdenite, in limestone intruded by grandiorite.

R. G. W.

VICTOR (IRIS). *Burnt Hill wolframite deposit, New Brunswick, Canada.* Econ. Geol., 1957, **52**, 149–168, 14 figs.

Wolframite ore occurs in a series of quartz-topaz fissure veins cutting across interbedded schists, phyllites, and quartzites one mile south of an exposed granite batholith. Early vein minerals include beryl, quartz, wolframite, biotite, topaz, cassiterite, molybdenite, apatite, muscovite, and scheelite. Later vein minerals are arsenopyrite, sphalerite, pyrrhotite, pyrite, chalcopyrite, galena, and native bismuth while the late non-metallic minerals are fluorite, prochlorite and calcite, together with clinochlore and muscovite as alteration materials. Native bismuth, which must have crystallized below 271.3°, was the last metallic mineral to crystallize. X-ray powder diffraction data are listed for prochlorite, clinochlore, 3T muscovite, and a mixture of 2M₁ and 1M muscovite.

R. A. H.

JACKSON (W. H.). *Geology of the Rocky Brook Area, York County, New Brunswick.* [M.A. Sci. Thesis, Univ. Toronto, 1955. 60 pp., 10 pls., 1 map.] Abstr. Canad. Mining Journ., 1956, **77**, 70.

Trace element data suggest that wolframite-quartz veins are related to a late, muscovite-rich border phase of a granite batholith and that the mineralizing solutions were hydrothermal.

W. R. G.

SHARP (BYRON J.). *Mineralization in the intrusive rocks in Little Cottonwood Canyon, Utah.* Bull. Geol. Soc. America, 1958, **69**, 1415–1430, 1 fig., 1 pl.

An area about 2 miles west of Alta, Utah, containing scheelite and molybdenite of possible economic value is described. The minerals occur in zones of jointing and fracturing which form a concentric pattern around an intensely fractured central zone. The more intense fracture zones are mainly within a leuco-quartz monzonite intrusive body which crops out in an oval area of 3 square miles, and which intrudes a Tertiary pluton called the Little Cottonwood quartz monzonite. The intrusive rocks are described in detail, but no analytical data are given. Three stages of mineralization are described.

A. L. A.

VARLAMOFF (N.). *Les gisements de tungstène au Congo Belge et au Ruanda-Urundi. Matériaux pour l'étude de leur géologie et de leur classification.* Mém. Acad. roy. Sci. Colon., Brussels, 1958, nouv. sér., **8**, fasc. 2, 73 pp., 11 figs., 7 pls.

The tungsten deposits of eastern Belgian Congo and Uganda present two types distinguished by the tungsten mineral, one having wolframite in large crystals, the other being ferberite, developed as pseudomorphs of scheelite crystals, with antigorite often present. The wolframite contains between 6 and 16% FeO, between 8 and 18% MnO. In the ferberite the content of MnO is consistently low 1%. The two types of deposit occupy different positions relative to the granitic masses; wolframite being situated on the granite cupolas, in the granite and in the intermediate aureole, ferberite in a zone further out. At Uganda only the latter zone is present, and the granitic cupola is supposed to lie in depth. From the deepest zone of mineralization, in the granite, towards the exterior zones in the aureole a progressive diminution in the content of MnO is observed in the tungsten mineral, corresponding to the lower temperature of its formation.

J. Th.

AMOVIĆ (MEHMED). *Pregled nalazišta minerala cinka i olova u Bosni i Hercegovini. Ein Übersicht von Zink und Blei Erzvorkommen in Bosnien und Herzegovina.* Geološki Glasnik, Sarajevo, 1957, 5–123, 106 figs., 9 pls. (Croatian with German summary.)

Numerous occurrences of lead and zinc ores in Bosnia and Herzegovina are classified and described. The primary sulphide deposits are assigned to three main periods of mineralization: (1) in Upper Palaeozoic times, associated with acid plutonism—sideritic and barytic lodes similar to those in the Bohemian Mass and the Harz; (2) in Triassic times, associated with geosynclinal vulcanism—veins, impregnations and submarine-hydrothermal barytes and pyrite deposits; and (3) in Tertiary times, associated with post-orogenic dacitic and andesitic vulcanism—quartz-pyrrhotine and siderite-marcasite veins with lead-zinc sulphides. The Quaternary cerussite deposits in Mesozoic karst country are compared with Tunisian deposits and attributed to weathering and redistribution of lead present originally in various Triassic formations. Many photomicrographs and chemical analyses of ores. Historical details. Bibliography of 41 items on Yugoslavian ore deposits.

F. W. D.

BAUMANN (LUDWIG). *Tektonik und Genesis der Erzlagerstätte von Freiberg (Zentralteil).* Freiberger Forschungshefte, 1958, C46, 208 pp., 135 figs., 5 pls.

A penetrating study of the lead-zinc-silver veins in the central Freiberg district. The classical notation of the vein 'formations' is retained. The silver-bearing veins of the 'Edle Quarzformation' in the Freiberg outskirts are not dealt with; they are referred to an earlier Namurian mineralization cycle. The second Freiberg mineralization cycle, to which all the remaining vein 'formations' belong, followed in Lower Rotliegende times and coincided with the

cooling and differentiation of the unexposed but geophysically located Freiberg Pluton. The complex fissure system, built up of two intersecting sets of associated shear and tension fissures, was complete before mineralization began. Successive sets of fissures were by stages opened and mineralized, starting with those coursing NE and proceeding anticlockwise. With each pause the composition of the solutions changed, so that the mineral content of the veins changes with direction as well as depth. Three main phases of mineralization, each with sub-phases, are recognized: (1) a Pb-Zn phase with quartz gangue ('Kiesig-blendige Bleierzformation'); (2) an Ag phase with predominantly carbonate gangue ('Edle Braunschpatformation'); and (3) a Bi-Co-Ni phase with predominantly fluorite-barytes gangue ('Fluorbarytische Bleierzformation' and 'Edle Geschicke'). The Pb-Zn-Cu-Fe sulphides deposited in phases (2) and (3) were all derived by secondary hydrothermal regeneration from the 'Kiesig-blendige Bleierzformation'; only the sulphosalts, arsenides, and native metals in these phases were primary. A complicated double zonal scheme relating to the two principal fissure sets is based on mineralographic and trace-element studies, and is distinguishable throughout the orefield despite strong telescoping. Two maps illustrate the double zonal scheme, and the distribution of mineral assemblages as a function of vein direction and depth is shown by means of ingenious coloured diagrams.

F. W. D.

METSGER (R. W.), TENNANT (C. B.), & RODDA (J. L.). *Geochemistry of the Sterling Hill zinc deposit, Sussex County, New Jersey.* Bull. Geol. Soc. America, 1958, 69, 775–788, 2 figs.

The Sterling Hill ore deposit is an intricately folded, steeply plunging body enclosed in Precambrian white marble. Ore minerals are willemite, franklinite, and zincite. Franklinite, tephroite, pyroxene, and biotite compose the less rich areas. Willemite seems to have been the first ore mineral to form, followed by tephroite, zincite, and franklinite in undetermined order. There is at least one later generation of willemite, zincite, and franklinite. The willemite is zoned in color and magnetic properties. The green willemite is a secondary mineral whose color is apparently a green fluorescence induced by ultraviolet wavelengths in daylight and artificial light sources. The variation from black to red willemite is due to color differences in inclusions, $<10\mu$, of franklinite. Red franklinite is nonmagnetic with a unit cell dimension of nearly 8.51 Å. Black franklinite is magnetic with a unit cell dimension of about 8.42 Å. Microscopic franklinite cell dimensions are intermediate. The larger cell dimension is correlated with increased manganese or zinc replacing iron. The franklinite inclusions are invariably associated with inclusions of serpentine and friedelite suggesting genetic relationship. The

origin of franklinite inclusions is attributed to a willemite serpentinization, similar to the formation of magnetite in serpentinization of olivine.

A. L. A.

REYNA (JENARO GONZÁLEZ), editor. *Symposium sobre yacimientos de manganeso, 2, África*. 20th Congreso Geol. Intern., México, 1956, 302 pp.

Contains papers outlining the geology, mineralogy, paragenesis, and history of production of manganese deposits in African territories.

BAUD (L.). *Les gisements et indices de manganèse de l'Afrique Equatoriale Française*. (pp. 9-38).

DE VILLIERS (J.). *The manganese deposits of the Union of South Africa*. (pp. 39-72).

KUPFERBURGER (W.), BOARDMAN (L. G.), & BOSCH (P. R.). *New considerations concerning the manganese ore deposits in the Post Masburg and Kuruman areas, northern Cape Province, Union of South Africa*. (pp. 73-87).

SERVANT (J.). *Les gisements et indices de manganèse de l'Afrique Occidentale Française*. (pp. 89-114).

ROPER (H.). *The manganese deposits at Otjösundu, South West Africa*. (pp. 115-122).

LUCAS (G.). *Gisements et indices de manganèse [en Algérie]*. (pp. 123-130).

SCHUILING (H.) & GROSEMANS (P.). *Les gisements de manganèse du Congo-Belge*. (pp. 131-142).

ATTIA (M. I.). *Manganese deposits of Egypt*. (pp. 143-171).

In the Abu Zenima district of the Sinai Peninsula pyrolusite, psilomelane, wad, haematite, and goethite occur as replacement deposits in Carboniferous sandstones and limestones : analyses are given for six dolomites remote from the ore deposits showing them to be ankeritic dolomite low in manganese. Six analyses of manganese ores from various Egyptian localities are listed.

GILL (D.) & FORD (S. O.). *Manganiferous iron ore deposits of the Om Bogma district, Sinai, Egypt*. (pp. 173-177).

BYRAMJEE (R.) & MEINDRE (M.). *Le gisement de manganèse de Guettara [Algérie]*. (pp. 179-196).

A syngenetic sedimentary manganese deposit occurs at Guettara, 200 km. south-west of Colomb-Béchar, south-west Algeria, where it is associated with a pyroclastic intercalation in Pre-Cambrian rhyolites. Although the ore is essentially braunite, psilomelane, and pyrolusite, other minerals which occur include rhodonite, bustamite, spessartine (SiO_2 35.5, Al_2O_3 19, TiO_2 0.5, FeO 5, MnO 23.6, MgO 0.1, CaO 13,

P_2O_5 0.2, H_2O 3, [=99.9], sp. gr. 3.75, n 1.8), whitite (SiO_2 58, Al_2O_3 3.6, TiO_2 0.1, FeO 0.6, MnO 2, MgO 20.4, CaO 5.2, Na_2O 6.2, K_2O 1.4, H_2O 1.5, 99.7), and the arsenates tilasite and possibly adelite.

PULFREY (W.). *Manganese deposits in Kenya*. (pp. 197-203).

Includes nine analyses of ores dominantly of pyrolusite but with some psilomelane and possibly manganeite. One deposit represents an impure diatomite impregnated with manganese, possibly as the result of hot spring action.

BOULANGER (J.). *Le manganèse à Madagascar*. (pp. 205-208).

— *Les gîtes de manganèse du sud de Madagascar et leur affinités Indiennes*. (pp. 209-216).

Pre-Cambrian manganese deposits in southern Madagascar strongly resemble the gondites of India and similar rocks from Africa and Brazil. The manganese is present as the silicates rhodonite (MnO_2 25.32, 22.55, 22.10%) and spessartine (MnO 6.4, 10.2%).

BOULADON (J.) & JOURAVSKY (G.). *Les gîtes de manganèse du Maroc (suivi d'une description des gisements du Précambrien III)*. (pp. 217-248).

Manganese deposits at Ouarzazate, Tiouine, and Idikel are described : at the latter locality the hydrothermal minerals include rhodonite, α 1.74 ; manganese dolomite, ω 1.700, analysis given of portion soluble in acetic acid ; rhodochrosite, ω 1.81, analysis given of portion soluble in acetic acid ; albite, α 1.52, γ 1.536 ; zinnwaldite, γ 1.575-1.612, 2V 18-39° ; lepidolite, γ 1.552, 2V 63° ; endichite, sp. gr. 6.97 ; acmite α 1.77, γ 1.80-1.81, ext. angle 7°, sp. gr. 3.51, and spessartine, n 1.80, sp. gr. 4.01.

VINCENNE (H.). *Observations géologiques sur quelques gîtes marocains de manganèse syngénétique*. (pp. 249-268).

GARSON (M. S.). *Manganiferous rocks in Nyasaland*. (pp. 269-272).

FOCKEMA (R. A. P.) & AUSTEN (A. L. S.). *Manganese deposits of Northern Rhodesia*. (pp. 273-291).

FERGUSON (J. C.). *Manganese in Southern Rhodesia*. (pp. 293-294).

GOTTIS (Ch.) & SAINTFIELD (P.). *Indices manganésifères en Tunisie*. (pp. 295-297).

R. A. H.

REYNA (JENARO GONZÁLEZ), editor. *Symposium sobre yacimientos de manganeso, 3, América*. 20th Congreso Geol. Intern., México, 1956, 440 pp.

Contains papers giving details of manganese deposits and their mineralogy, paragenesis, and history of mining and production.

- HANSON (G.). *Manganese in Canada.* (pp. 9-14).
- SARGENT (H.). *Manganese occurrences in British Columbia.* (pp. 15-34).
- MAPES V. (E.). *El manganeso en México.* (pp. 35-78). Contains three complete and several partial analyses of manganese ores.
- REYNA (J. GONZÁLEZ). *Los yacimientos de manganeso de El Gavilán, La Azteca y Guadalupe, Baja California, México.* (pp. 79-96).
- WILSON (I. F.). *The Lucifer manganese deposits, Baja California, México.* (pp. 97-108).
- WILSON (I. F.). *Manganese deposits of the Sierra de Borregos, Chihuahua, Mexico.* (pp. 109-124).
- & ROCHA (V. S.). *The Talamantes manganese deposits, Chihuahua, Mexico.* (pp. 125-132).
- *Manganese deposits of the Montana de Manganeso Mine, San Luis Potosí, México.* (pp. 133-139).
- *Manganese deposits of La Abundancia and La Esperanza mines, Zacatecas, México.* (pp. 141-149).
- JIMÉNEZ V. (S.). *Yacimientos de manganeso comprendidos dentro de la región de Terrenates, Chihuahua.* (pp. 151-155).
- MAPES-VÁZQUES (E.). *El yacimiento de manganeso de Guadalupe No. 2, Baja California.* (pp. 157-168).
- HEWETT (D. F.), CRITTENDEN (M. D.), PAVLIDES (L.), & DE HUFF (G. L., Jr.). *Manganese deposits of the United States.* (pp. 169-230).
- JICHA (H. L., Jr.). *Manganese deposits of the Luis Lopez district, Socorro County, New Mexico.* (pp. 231-253). The ores consist mainly of banded botryoidal manganese oxide minerals, with calcite, quartz, anhydrite, and barite; the host rock is massive rhyolite. The results of 12 assays are tabulated.
- KEGEL (W.). *Manganese deposits of the State of Bahia [Brazil].* (pp. 257-260).
- BARBOSA (O.). *Manganese at Urucum, State of Mato Grosso, Brazil.* (pp. 261-274).
- POUCHAIN (E. B.). *Other occurrences of manganese [Brazil].* (pp. 275-277).
- DORR (J. VAN N., II), COELHO (I. S.), & HOREN (A.). *The manganese deposits of Minas Gerais, Brazil.* (pp. 279-346). The high-grade ores are largely the results of supergene enrichment of lower grade protores: the latter include manganese silicate-carbonate (gondite and queluzite), marble-itabirite, and clastic material including tuffaceous rocks. Chemical analyses are given of six manganiferous marbles, fourteen manganese ores, and five silicate-carbonate protores.

PARK (C. F., Jr.). *Manganese ore deposits of the Serra do Navio district, Federal Territory of Amapa, Brazil.* (pp. 347-376).

The ore consists dominantly of cryptomelane in metamorphosed intercalated sediments and volcanic rocks. It contains fresh spessartine garnet (90% spessartine; $n = 1.792-1.796$, $a = 11.60 \text{ \AA}$, sp. gr. 4.09). Alternative hypotheses of origin are discussed.

BIESE (W. A.). *Los yacimientos de manganeso de Chile.* (pp. 377-416).

VITELMO TEZÓN (R.) & IGLESIA (H. J. DE LA). *Depósito de manganeso, oro y plata 'Farellón Negro', Provincia: Catamarca, Argentina.* (pp. 417-434).

RÜE (E. A. DE LA). *Sur la présence de dépôts de wad aux îles Saint-Pierre et Miquelon.* (pp. 435-440).

R. A. H.

VACHTL (JOSEF). *Recké bauxity, jejich výskyt, stáří a minerální složení [Greek bauxites, their occurrences, geological age and mineralogical contents].* Veštík Ústředního ústavu geologického, 1956, 31, 105-114, 3 figs. (Russian and English summaries.)

Details are given of the geological structure and tectonic conditions. X-ray and d.t.a. investigations of bauxites from Aspra Spitia have proved that most of them consist of diaspore; in some boehmite is prevalent; there has been found no evidence for the supposition that different temperatures would be required for the formation of boehmite or diaspore.

F. S.

PEGAU (ARTHUR A.). *Titanium. Virginia Division Geol., Min. Resources Circ., 1956, no. 5, 1-17, 1 fig.*

A brief summary is given of the characteristics, uses, mineralogy, geology, geography, and world production of titanium. In a separate section the production, distribution, and geology of titanium deposits in Virginia are considered. An extensive bibliography on Virginia titanium deposits is included.

R. S. M.

MORÁVEK (PETR.). *Vizmutové minerály ze Šlojířské žíly v oblasti dolu Pepř u filového.* [Bismuth minerals from the Slojíř vein in the area of the mine Pepř near Jílové.] Casopis pro mineralogii a geologii, 1956, 1, 223-232 and 294. (Russian and English summaries.)

Besides metallic bismuth and bismuthinite found recently by J. Sobotka [following abstract] and tetradyomite, found by K. Paděra, the author has determined by X-rays cosalite kobellite, and tellurbismuth Bi_2Te_3 . For all six minerals structural data and paragenesis are given.

F. S.

SOBOTKA (Jiří). *Zpráva o výskytu bismutinu a vizmutu na zlatonošných žilách v Jílovém.* [Note on the occurrence of bismuthinite and bismuth in the auriferous veins in Jílové.] Casopis pro mineralogii a geologii, 1956, 1, 297-298. (Russian and English summaries.)

The find of bismuth minerals at Jílové, like the occurrence of wolframite in the gold-bearing district of Kasejovice and the author's former find of scheelite at Jílové, testifies to the close genetic connection of the auriferous veins with the granitic and granodioritic pluton of middle Bohemia.

F. S.

HEINRICH (E. Wm.). *Economic geology of the rare-earth elements.* Mining Mag., 1958, 98, 265-273.

A review of the geochemistry and mineralogy of both the cerium and yttrium groups of rare earths which includes examples of their paragenesis illustrating their geological ubiquity. The significant steps in the complete and sharp fractionation of the rare earths in highly pure form by ion-exchange are briefly outlined, and the uses and potential uses of the rare earth elements are tabulated. Clues for prospectors include the fluorescence of associated minerals, particularly in shades of red or green, because of their rare-earth contents.

R. A. H.

MCKEOWN (F. A.) & KLEMIC (HARRY). *Rare-earth-bearing apatite, at Mineville, Essex County, New York.* Bull. U.S. Geol. Survey, 1957, 1046-B, 9-23, 6 figs.

Apatite separated from magnetite ore from the Mineville district gave an average value of 0.032 U, 0.15 Th, 11.14 rare-earth oxides, though there was some intergrown monazite, bastnaesite, and haematite. Two types of magnetite ore occur in the district, one high in phosphorus and one low; none of the low phosphorus ores is radioactive. Semi-quantitative spectrographic analyses and partial chemical and radiometric analyses are given for fourteen apatites.

R. A. H.

WARD (S. H.) & BARKER (R. A.). *Case history of the Juniper prospect.* Mining Engineering, A.I.M.E., New York, 1958, 10, 100-104.

Found by electromagnetic and gravity surveys in 1955, this prospect in Carleton County, New Brunswick, has now been drilled. All cores contain disseminated pyrite and marcasite (?) as well as veinlets with pyrite, pyrrhotite, and some chalcopyrite, sphalerite, galena, and arsenopyrite.

R. G. W.

JENNEY (C. P.). *New Brunswick develops a major mining camp.* Engineering Mining Journ., New York, 1957, 158, 95-96.

Nine individual sulphide replacement deposits of the Bathurst-Newcastle area are briefly described. R. G. W.

CLARK (LLOYD A.). *Sulphide deposits of the Hanson Lake area, Saskatchewan.* [M.Sc. Thesis, Univ. Saskatchewan, 1955, 53 pp., 7 figs., 7 tables, 5 maps.] Abstr. Canadian Mining Journ., 1956, 77, 70.

There was no lithologic control but some fracture controls of sulfide deposition. A spatial relationship suggests that the ore is related to granodiorite which forms small intrusive masses.

W. R. G.

SCHOEWE (WALTER H.). *The mineral industry in Kansas 1950 to 1954.* Bull. Kansas Geol. Survey, 1956, 111, 105-174., 2 figs.

Kansas produced \$2,100,000,000 in mineral wealth between 1950 and 1954 of which mineral fuels contributed about 85, nonmetals 13, and metals 2%. A. Sw.

SCHOEWE (WALTER H.). *The mineral industry in Kansas in 1955.* Bull. Kansas Geol. Survey, 1956, 119, 267-326, 3 figs. A. Sw.

SCHOEWE (WALTER H.). *The mineral industry in Kansas in 1956.* Bull. Kansas Geol. Survey, 1957, 127, 179-229, 3 figs. A. Sw.

GOODWIN (J. GRANT). *Mines and mineral resources of Tulare County, California.* Calif. Journ. Mines Geol. 1958, 54, 317-492.

Natural gas, nonmetallic mineral resources (magnesite sand, gravel, granite, chrysoprase, crushed rock) and wolfram have been the chief economic mineral resources in the past.

K. S.

HALL (WAYNE E.) & MACKEVETT (E. M.). *Economic geology of the Darwin quadrangle, Inyo County, California.* California Div. of Mines Spec. Rept. 51, 1958, 73 pp. Price \$2.50.

The principal ore mineral in the lead-silver-zinc deposits is argentiferous galena but other hypogene minerals include sphalerite, pyrite, pyrrhotite, chalcopyrite, tetrahedrite, scheelite, andorite, franckeite, stannite, enargite-famatinite (?), matildite, bismuth (?), and an unknown lead-bismuth-selenium sulpho-salt [prominently striated silver-white tabular mineral]. Supergene minerals include 'limonite', hemimorphite, cerussite, anglesite, hydrozincite, plumbojarosite, pyromorphite, smithsonite, and locally also aurichalcite, azurite, brochantite, caledonite, chrysocolla, linarite, and malachite. Many other minerals, including some rare species, occur in the zone of oxidation and as gangue.

K. S.

DAVIS (FENELON F.) & GOLDMAN (HAROLD B.). *Mines and mineral resources of Contra Costa County, California.* Calif. Journ. Mines Geol., 1958, 54, 501-583.

clay, peat, natural gas, sand, and stone were the principal mineral commodities produced during 1957. Sulfur and H₂S produced as by-products of petroleum refining, the principal industry. Substantial quantities of coal, cement, mercury, mineral water, and a small amount of pumice have been produced in the past.

K. S.

LL (JOHN R.). *Geology and mineral resources of the Carlinville quadrangle*. Bull. Illinois State Geol. Survey, 1952, **77**, 110 pp.

The resources are clay, coal, oil and gas, sandstone, limestone, peat, sand and gravel. The clays are illitic. Ceramic tests for the clays and shales and chemical data for the limestones are given.

W. A. Wh.

EXPERIMENTAL MINERALOGY

OMLINSON (J. W.), HEYNES (M. S. R.), & BOCKRIS (J. O'M.). *The structure of liquid silicates. Pt. 2. Molar volumes and expansivities*. Trans. Faraday Soc., 1958, **54**, 1822–1833, 10 figs.

Measurements have been made of the densities of liquid silicates in the MgO—SiO₂, CaO—SiO₂, SrO—SiO₂, and BaO—SiO₂ systems in the temperature range 1600–1950°C [A.A. **13**–112, 485].

R. A. H.

KHITAROV (N. I.), SLUTZKY (A. B.), & ARSENIEVA (R. V.)] Хитаров (Н. И.), Слутцкий (А. Б.) и Арсеньева (Р. В.). Синтез и характеристика коссита—устойчивой модификации кремнезема при высоких давлениях. [*Synthesis and characteristics of coesite—the stable modification of silica at high pressures*.] Геохимия, Изд. Акад. Наук. СССР [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1957, no. **8**, 666–672, 6 figs.

An apparatus similar to that devised by Griggs and Kennedy is described, followed by description of an experiment in which amorphous silica was subjected to temperatures between 450 and 600°C and pressures of 26,000 to 8,000 atmospheres. The final products were quartz and coesite [M.A. **12**–409, 410, **13**–267]. Coesite appears in the form of well-crystallized idiomorphic transparent plates with a maximum size of 0.7 mm. It has positive elongation, $\epsilon = 1.594$, $\gamma = 1.597$, $2V(-) = 61^\circ$, $\gamma \parallel c$. X-ray data give cell dimensions exactly the same as those given by Ramsdell. M.A. **13**–485]

S. I. T.

CARR (R. M.) & FYFE (W. S.). *Some observations on the crystallization of amorphous silica*. Amer. Min., 1958, **43**, 908–916, 6 figs.

Observations have been made on the effect of pressure and temperature on the rate of formation of quartz from so-called silicic acid. Pressures used ranged from 15,000 to

BUDGE (CHRISSIE E.). *The mineral resources of North Dakota*. Bull. North Dakota Research Foundation, 1954, **8**, 68 pp.

Short descriptions of deposits of economic rocks and minerals. The manganese mineral ranciéite and the sodium sulphate mineral thenardite are only briefly noted.

R. A. Hp.

LAMAR (J. E.). *Clay and shale resources of extreme southern Illinois*. Illinois State Geol. Survey Rept. Invest., 1948, **128**, 107 pp.

Gives description of clay and shale formations, with 32 chemical analyses.

W. A. Wh.

50,000 lb/in², temperatures from 330 to 448°C and duration of experiments reported from 6 to 840 hours. The rate is much more sensitive to changes in pressure than to changes in temperature. Cristobalite and silica-K appear as intermediate phases before quartz is formed.

A. P.

WHITE (J. F.), SHAW (E. R.), & CORWIN (J. F.). *A chalcedony-like variety of germania*. Amer. Min., 1958, **43**, 580–584, 1 fig.

A fibrous variety of GeO₂ (quartz type) has been produced hydrothermally. It has anomalous physical and optical properties analogous to those of chalcedony. Refractive indices of chalcedonic germania are reported as 1.653 and 1.633. For quartz type GeO₂ $\omega = 1.697$ and $\epsilon = 1.724$, differing slightly from earlier published values, are reported.

A. P.

NELSON (B. W.) & ROY (RUSTUM). *Synthesis of the chlorites and their structural and chemical constitution*. Amer. Min., 1958, **43**, 707–725, 8 figs., 2 tables.

Experimental hydrothermal studies on both synthetic and natural chlorites reveal the polymorphic relationship between 7 Å sheet trioctahedral phases and true 14 Å chlorites. Both polymorphs can be synthesized in the composition range from amesite to penninite, generally the 7 Å series forms under lower temperature-pressure conditions. Both polymorphs allow continuous extensive isomorphous replacement of 2 Al³⁺ for Si⁴⁺ + Mg²⁺ ending at the amesite composition. The maximum stable temperature at equilibrium for the chlorites is 710°C at 20,000 lb/in² at the clinochlore composition; it decreases slightly (by about 20°C) towards both penninite and amesite. Two versions of the composition-temperature diagram for the join chrysotile-amesite in the system MgO–Al₂O₃–SiO₂–H₂O are given. Chemical changes in the chlorites are continuous and wide

and there is no simple replacement of aluminium by magnesium. The term 'septachlorite' is advocated for the 7 Å analogues of the 14 Å true chlorites.

B. H. B.

KLINGSBERG (CYRUS) & ROY (RUSTUM). *Synthesis, stability and polytypism of nickel and gallium phlogopite.* Amer. Min., 1957, **42**, 629-634, 1 fig.

Phlogopites have been synthesized with Ni^{2+} substituting for Mg^{2+} and Ga^{3+} for Al^{3+} . The nickel phlogopite was prepared as the 3T polytype and had $\gamma 1.652$; $a 5.300$, $c 30.51\text{\AA}$, and a basal spacing of 10.17\AA ; the indexed X-ray powder data are listed. The gallium phlogopite had $\gamma 1.598$, and a basal spacing of 10.26\AA ; it could not be definitely assigned to any polymorphic variety. The decomposition temperatures of these phlogopites under hydrothermal conditions are compared with that of magnesium phlogopite [M.A. 12-517]; the substitution of nickel hardly affects the stability, while the replacement of Al^{3+} by Ga^{3+} lowers the equilibrium dissociation temperature by 100°C . R. A. H.

GAINES (GEORGE L., Jr.) & RUTKOWSKI (C. P.). *The extraction of aluminium and silicon from muscovite mica by aqueous solutions.* Journ. Physical Chem., 1957, **61**, 1439-1441.

Values are given for the amounts of Al and Si extracted from muscovite mica after grinding to 20-40 mesh or 100-200 mesh and using solutions of 0.1 N HCl, 0.1 N KOH, 0.1 N KCl, and water. The acid solutions give the highest extractions and it is postulated that the acid attack occurs primarily at the edges of the particles where the octahedral layer is exposed and that it is this layer which is mainly attacked.

R. A. H.

BUCKLE (E. R.) & TAYLOR (H. F. W.). *A calcium analogue of chondrodite.* Amer. Min., 1958, **43**, 818-823, 2 figs.

A calcium analogue of chondrodite, of composition $\text{Ca}_5(\text{SiO}_4)_2(\text{OH})_2$, has been prepared hydrothermally from tricalcium silicate at $600-700^\circ\text{C}$. Cell dimensions are $a 11.42$, $b 5.05$, $c 8.94\text{\AA}$, $\beta 109.3^\circ$, space group $P2_1/a$, $Z=2$. The crystals are prisms elongated parallel to b , up to 0.07 mm long. Mean refractive index is 1.630 , birefringence very low, elongation positive. Dehydration occurs at $650-700^\circ\text{C}$. An indexed X-ray powder diffraction pattern is tabulated.

A. P.

HIGGS (DONALD V.) & HANDIN (JOHN). *Experimental deformation of dolomite single crystals.* Bull. Geol. Soc. America, 1959, **70**, 245-278, 20 figs., 6 pls.

Jacketed cylindrical specimens of dolomite single crystals were deformed dry under a constant confining pressure of 5000 bars at a strain rate of 1% per minute at temperatures from 24°C to 500°C . Unaxial compression and extension

experiments were carried out with the load in four different orientations. In the two orientations unfavourable for basal translation, crystals loaded at temperatures below 400°C are brittle and fail on shear fractures, which are inclined about 30° to the direction of greatest principal pressure. At 400°C and above, specimens with these orientations show basal twin gliding on $f\{02\bar{2}1\}$ in a negative direction sense. Large permanent deformations are achieved at all temperatures in the two orientations favourable for translation gliding. Below 400°C , the translation gliding is on $c\{0001\}$ along the gliding line that is parallel to a . At 500°C twinning occurs to the exclusion of translation, but both mechanisms are operative at 400°C . The critical resolved shear stress for translation increases with temperature up to about 400°C , the critical stress for twinning decreases in the range 400°C to 500°C , and the two critical stresses are equal about 400°C . A few magnesite crystals were deformed parallel to C_v under similar conditions. Basal translation cannot occur in this orientation, but translation on $r\{10\bar{1}\}$ along the line $[1011 : 02\bar{2}1]$ does occur. No twinning was detected.

A. L. A.

PATERSON (M. S.). *The melting of calcite in the presence of water and carbon dioxide.* Amer. Min., 1958, **43**, 602-606, 2 figs.

Calcite was melted in a pressure vessel under a total pressure of 50 bars of water and CO_2 , and in some cases crystallized between 900 and 1000°C . This probably corresponds to the classic experiments of Sir James Hall. A. P.

KURUP (K. N. N.) & MOOSATH (S. S.). *Studies on Travancore monazite. VI. Investigation on the solid-solid reaction between monazite and sodium carbonate by differential thermal analysis and by X-ray diffraction.* Proc. Indian Acad. Sci., 1958, **48**, A, 76-83, 10 figs.

This study was carried out in connection with the determination of the optimum conditions for the removal of phosphatic content in monazite sand by sintering with sodium carbonate. The reaction is shown to be a slow exothermic one from $400-760^\circ\text{C}$.

R. A. H.

BARTON (PAUL B., Jr.). *Synthesis and properties of carnotite and its alkali analogues.* Amer. Min., 1958, **43**, 799-817, 1 fig.

Carnotite and its Na, Rb, Tl, Cs, and (H_3O) (?) analogues have been synthesized in several ways in attempts to get single crystals for X-ray study. Aqueous methods failed to yield suitable crystals but simple fusion, using metavanadate fluxes, gave satisfactory results. The rate of precipitation of carnotite from aqueous solution as a function of pH suggests that interaction between uranyl, alkali, and metavanadates is involved. Cell dimensions and optical constants are

reported for all the phases synthesized from melts and sp. gr. is reported for all except the Na-carnotite. This is less stable than the others. Indexed X-ray powder diffraction patterns are tabulated for all of these phases and for the presumed hydronium carnotite.

A. P.

AMES (L. L.) & SAND (L. B.). *Hydrothermal synthesis of wairakite and calcium-mordenite.* Amer. Min., 1958, **43**, 476-480.

The zeolites wairakite ($\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot 2\text{H}_2\text{O}$) and calcium-mordenite ($\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 10\text{SiO}_2 \cdot 7\text{H}_2\text{O}$) were synthesized hydrothermally, wairakite from 315 to 400°C and calcium-mordenite from 340 to 380°C, both at 1000 atmospheres. Wairakite was obtained only in the presence of excess silica.

[M.M. 30-691, 699]

A. P.

LEPP (H.). *The synthesis and probable geological significance of melnikovite.* Econ. Geol., 1957, **52**, 528-535.

The aged precipitate formed by the action of hydrogen sulphide on dilute alkaline ferrous solutions at room temperature has properties nearly identical with those recorded for the discredited mineral melnikovite. It gives a distinctive X-ray powder pattern (data listed). It is black, cryptocrystalline, and magnetic. At temperatures above 75°C it changes to pyrite. It reacts with carbonated water at room

temperatures to form ferrous bicarbonate. [M.A. 8-183, 9-281]

G. D. N.

PROUVOST (JEAN). *Remarque sur le spectre de Debye et Scherrer de la stromeyerite et sur la synthèse de ce minéral par frittage.* C.R. Acad. Sci. Paris, 1955, **241**, 217-219.

Stromeyerite is obtained by submitting a mixture of powdered covellite and silver to a high pressure and then raising the temperature to a determined value. Debye-Scherrer spectra of the artificial product are absolutely analogous to those given by natural sulphide of silver and copper. (Author's abstract.)

E. J. & A. S.

COTTER (P. G.). *Microhardness of aluminium boride monocrystals.* Amer. Min., 1958, **43**, 781-784, 4 figs., 1 table.

Aluminium boride (AlB_{12}) crystals were synthesized by heating Al chips + anhydrous B_2O_3 under argon, and by the aluminothermic method. By the first method yellow elongate to equant orthorhombic crystals, some showing red to yellow pleochroism; by the second method red tabular pseudohexagonal crystals were obtained. No crystals were more than 5 mm long. The microhardness of yellow AlB_{12} crystals is about 2750 K₁₀₀, that of red AlB_{12} crystals is about 2430 K₁₀₀. The yellow crystals are harder than silicon carbide and nearly as hard as boron carbide.

B. H. B.

GEMSTONES

RUTLAND (E. H.). *Vest-pocket polariscope.* Gemmologist, 1954, **22**, 103-104.

A small polariscope, not much larger than a pocket loupe, is described. Polaroid discs are used and the gemstone is held in a cell which fits firmly in the body of the instrument. The upper disc is rotatable.

G. F. A.

TRUMPER (L. C.). *Further colour filter tests.* Journ. Gemmology, 1957, **6**, 78-80.

Notes on the limited use of colour filters in distinguishing between yellow and orange-coloured gemstones. G. F. A.

ANDERSON (B. W.). *The refractometer and other refractive index methods.* Journ. Gemmology, 1955, **5**, 166-178.

The first Herbert Smith Memorial lecture. The development and powers of the direct-reading type of refractometer first designed by G. F. Herbert Smith are described, and the limitations imposed by the lack of suitable contact liquids of high index are discussed. In addition to refractometer techniques the Duc de Chaulnes method of real and apparent depth under the microscope is briefly described and the usefulness of immersion contrast methods emphasized. The

minimum deviation method has little practical value for the gemmologist except in the measurement of dispersion.

G. F. A.

GÜBELIN (E. J.). *Application of phase contrast microscopy in gemmology.* Journ. Gemmology, 1957, **6**, 151-165, 8 figs.

Following an outline of the technique, the use of phase contrast microscopy in studying inclusions and inhomogeneities in minerals and gemstones is demonstrated with the aid of paired photographs taken by bright field and phase contrast illumination.

R. A. H.

TRUMPER (L. C.). *The design and construction of a gemmological spectroscope.* Journ. Gemmology, 1958, **6**, 271-289, 3 figs.

Full details are given for the construction of a spectroscope for the study of the absorption spectra of gemstones.

R. A. H.

ANDERSON (B. W.) & PAYNE (C. J.). *The spectroscope and its applications to gemmology.* Gemmologist, 1955, **24**, 92-95 (part 21) to 1957, **26**, 13-14 (part 40).

Parts 21-40 of a very complete research paper, the most

valuable of its kind that has been published. The series has an index and it is to be hoped that it will be published in book form as the papers are so widely spread. [M.A. 12-600]

G. F. A.

ANDERSON (B. W.). *More notes on immersion contact photography.* Journ. Gemmology, 1956, **5**, 297-306.

'Immersion contact photography' of gemstones, first described in 1952, has since proved useful in discriminating between natural and synthetic gemstones. If a synthetic corundum is immersed in a glass cell containing methylene iodide and a parallel beam of light passed through it on to a photographic film, then, provided the stone is in a favourable orientation, the processed film may show the curved striae typical of such synthetics even where these are invisible with lens or microscope. Further, as suggested by Mr. Norman Day, stones resting on printing paper in a dish of water and briefly illuminated from above by short-wave ultra-violet light may reveal on the processed paper sharp differences in transparency to short-wave light. In particular, synthetic ruby and synthetic emerald are found to be notably more transparent to ultra-violet light than their natural counterparts [M.A. 12-164].

G. F. A.

WEBSTER (R.). *X-rays and their use in gemmology.* Gemmologist, 1955, **24**, 106-109, 131-135, 148-151, 15 figs.

X-rays are used in gem testing in three ways—by the luminescence induced by the rays; by the variable transparency of different material to the rays and by diffraction of the rays from the atomic planes of the gem material. The use of differential transparency for testing gems and pearls is discussed.

G. F. A.

CROWNINGSHIELD (G. R.). *Ascertaining the nature and extent of damage or inherent flaws in gemstones.* Journ. Gemmology, 1958, **6**, 355-359; Gems & Gemology, 1958, **9**, 131-133, 159.

Mainly a warning to make sure that inherent flaws or fractures in gemstones are recognized in order that these cracks, etc. may be distinguished from later accidental damage. A star sapphire is reported to have been neatly split into three pieces due to failure to remove it from its setting when the shank was being enlarged by hammering, the stone having well developed (1011) twinning.

J. A. H. & R. A. H.

CHUDOBA (K. F.). *Chromium as colouring agent in precious stones.* Journ. Gemmology, 1957, **6**, 53-62, 2 figs.

All precious stones with chromium as colouring agent are predominantly green, otherwise red. It is not certain what role can be attributed to chromium if other colouring elements are also present. The conclusion is reached, based on

papers of Feinknecht and Schmitz-Du Mont, that the bi-chromatic effect of chromium as a colouring agent is connected in the first instance with the relative strength of the crystal field.

G. F. A.

COULSON (C. A.) & KEARSLEY (MARY J.). *Colour centres in irradiated diamonds. I.* Proc. Roy. Soc., 1957, **241**, A, 433-454, 5 figs.

A theoretical calculation of the energy levels, and hence absorption spectrum, of an isolated vacancy in an otherwise perfect diamond lattice has been made, and the concept of a defect molecule is introduced. The results suggest that the observed band at 2.0 eV causing irradiated diamonds to appear blue is due to spin and orbitally allowed electronic transitions in the neighbourhood of isolated neutral vacancies.

R. A. H.

SHIPLEY (R. M., Jr.). *Electronic colorimeter for diamonds.* Gems & Gemology, 1958, **9**, 136-142, 158.

The history of the development of a colorimeter for diamonds by the Gemological Institute of America from the late 1930's to date. A description of the present form and its use is given with the admission that it is not a satisfactory gauge of brown stones. It is claimed to standardize 'diamond color grading throughout the country with a dependability that is impossible by other means'.

J. A. H.

SWEET (JESSIE M.) & MOSS (A. A.). *Mr. Clayton's diamond* Journ. Gemmology, 1955, **5**, 125-130.

Experiments (1663) by Robert Boyle with a phosphorescent diamond belonging to a Mr. Clayton are recalled. Tests by the authors with diamonds which were strongly fluorescent under ultra-violet light showed that these had a persistent phosphorescence after exposure to the rays, and that later the stones glowed again in hot water ('thermoluminescence'). A weak glow in hot water could also be seen in a diamond which had been exposed to dull daylight for four hours, or to tungsten light, but not if a filter cutting out ultra-violet rays had been interposed. Activating wavelengths were found to lie between 3910 and 3130 Å, and luminescent diamonds appeared all to belong to the type I category.

B. W. A.

BUNTING (E. N.) & VAN VALKENBURG (A.). *Some properties of diamond.* Amer. Min., 1958, **43**, 102-106, 3 figs.

Chemical and physical tests were made on more than 1100 gem diamonds. In infrared light all diamonds show an absorption band near 5 μ. Type I diamonds further show marked absorption in the range 8 to 10 μ. Diamonds referred to as type I modified and type I highly modified

now only moderate or low absorption in this range. Type II diamonds, which are much rarer, show little absorption in this range. Spectroscopic examination of several type I and type II diamonds for Al, B, Ca, Cu, Fe, Mg, Na, and Si revealed no correlation between the amounts of these impurities and type of diamond.

A. P.

CUSTERS (J. F. H.) & SIMPSON (H. R.). *Etch trigons on diamonds.* Nature, 1954, **173**, 738, 2 figs.

[M.A. 13-451].

P. J. B.

CUSTERS (J. F. H.). *Large type II diamonds.* Nature, 1955, **176**, 360.

The four largest diamonds of the finest gem quality from the Premier Mine, Transvaal, and from S.W. Africa are all of type II.

D. J. S.

CROWNINGSHIELD (G. R.). *Spectroscopic recognition of yellow bombarded diamonds and bibliography of diamond treatment.* Gems & Gemology, **9**, 99-104, 117, 4 figs.

In contrast with surface treatment, bombardment with fast neutrons effects penetration throughout the stone and no visible evidence remains. Observation of absorption spectra appears to offer the best means of recognizing yellow bombarded diamonds. The results of spectroscopical examination of known natural and known bombarded yellow stones, as well as of some of uncertain history are reported and it is shown that a 5920 Å line is present in all bombarded yellow stones. In none of hundreds of coloured industrial stones which were too flawed or poorly textured to be worth treatment was the 5920 Å line observed. It appeared, however, in two stones of uncertain history and of a colour which would not be expected from neutron treatment. One of these stones showed lines not hitherto recorded in the literature at approximately 5500 Å and 5640 Å. A 5040 Å line may occur in natural stones but is also induced in treated stones; the presence of this line is good evidence according to R. A. Dugdale (Brit. Journ. App. Phys., **4**-334) that heat treatment took place below

350°C. The author notes also that lines due to treatment will disappear temporarily if the stone becomes hot enough to be uncomfortable to hold. The Gemological Institute of America has arbitrarily set the year 1950 as the date after which any yellow diamond is suspect and is of opinion that the presence of the 5920 Å line particularly if accompanied by a 5040 Å is strongly indicative of colour induced by bombardment. Spectra of natural and bombarded stones are illustrated. An extensive bibliography [which omits Sir W. Crookes's paper in Phil. Trans. Roy. Soc. London, 1914, **214**, A, 438] is given. [The 5920 Å line is perhaps a more accurate determination of the 'approximately 5960 Å' line, M.A. 13-610.]

J. A. H.

CUSTERS (J. F. H.). *Minor elements in diamonds and their effect on diamond colors.* Gems & Gemology, 1958, **9**, 111-114.

The author believes minor elements play a predominant role in most cases of diamond color although the exact nature of color centers is conjectural. Coloring due to bombardment or irradiation cannot be due to minor elements since it is altered by heating to 450°C though some of the impurity elements may be transmuted under bombardment. The Diamond Research Laboratory in trying to establish a relation between the color of diamonds and their impurity-element finds that normally more than one element is present. They have established, however, that mauve and pink colors are most probably due to one element only, manganese. Absorption curves for colorless, mauve, and light pink diamonds are given. Semi-conductivity and color are related. Without exception all natural blue diamonds are semi-conducting; a few of the semi-conducting diamonds were of pale brown color. Diamonds containing much larger quantities of the minor elements which are only spectrographically detectable in natural blue stones were not blue. The author thinks that the blue color of the great majority of semiconducting stones may be due not to an impurity but rather to some lattice defect responsible also for its electrical properties.

J. A. H.

GEOCHEMISTRY

DAMON (PAUL E.) & KULP (L. LAWRENCE). *Excess helium and argon in beryl and other minerals.* Amer. Min., 1958, **43**, 433-459, 5 figs.

All beryl crystals appear to contain a quantity of He and Ar in great excess over that which can be accounted for from radioactive decay. Other minerals such as cordierite and tourmaline which have structural sites suitable for large non-essential atoms also show this excess in variable amount. This inert gas must represent a sample of the magmatic

gases in the immediate environment of the forming crystal and as such can provide information on magmatic conditions. Though the differences in the He and Ar concentrations even within one beryl crystal may be considerable, they are small compared with the hundred-fold difference between crystals formed in the early Precambrian and in the Palaeozoic eras. This strong age effect is interpreted as suggesting more extensive evolution of gas from the mantle in the earlier phases of earth history.

A. P.

ALTSCHULER (Z. S.), CLARKE (R. S., Jr.), & YOUNG (E. J.). *Geochemistry of uranium in apatite and phosphorite.* U.S. Geol. Survey Prof. Paper, no. 314-D, 1958, pp. 45-90. Price 60 cents.

Because apatite is a minor constituent of many rocks and is a major constituent in some large deposits it accounts for the dispersal and concentration of uranium in nature even though apatite contains only traces of uranium. Between 0.001 and 0.01% of primary igneous apatite and from 0.005 to 0.02% of sedimentary marine apatite consist of uranium. Thorium is more abundant than uranium by a factor of 3-4 in igneous apatite. Because ionic radii of tetravalent uranium and of divalent calcium are very nearly the same and because much of the uranium is igneous, sedimentary, and bone apatite is tetravalent, uranium replaces calcium in the apatite structure. Uranium may be leached from or introduced into apatite by ground water. The pattern of enrichment reflects the condition and intensity of weathering.

K. S.

LIEBENBERG (C. J.). *The spectrochemical determination of Cs in igneous rocks, using a chemical concentration method.* Geochim. Cosmochim. Acta, 1956, **10**, 196.

The concentrations of Cs in nordmarkite, syenite, and nepheline syenite from Kangerdlugssuaq, East Greenland, are respectively .38, .55, and .8 p.p.m. J. R. B.

ALPEROVITCH (E. A.) & MILLER (J. M.). *Occurrence of technetium-98 in nature.* Nature, 1955, **176**, 299-301, 1 fig.

The method of neutron activation analysis was used to detect ^{98}Tc in columbite, chromite, thortveitite, and yttrontantalite by converting it to $^{99\text{m}}\text{Tc}$. Whether the $^{99\text{m}}\text{Tc}$ detected in some samples was produced by the (n, γ) reaction with ^{98}Tc and by no other process has not been fully established. Further analyses are to be carried out and a detailed account published. D. J. S.

ŽEMLIČKA (JAN). *Geochemie titanu při větrání vulkanických hornin.* [Geochemistry of titanium in the weathering of volcanic rocks.] Věstník Ústředního ústavu geologického, 1956, **36**, no. 4, 180-195, 8 figs., 1 pl. (Russian and English summaries.)

At Skršín near Most (N.W. Bohemia) weathered basalt tuffs contain 7.5% TiO_2 on average; a part is present in metastable form probably as colloid-dispersed hydroxide, part as dispersed secondary anatase, and another and least part as relics of rutile, ilmenite, anatase, and leucoxene.

F. S.

PELÍŠEK (JOSEF). *Spectrálně chemický výzkum axinitu od Nedvědice (SZ Moravia).* [Spectrochemical investigation of axinite from Nedvědice in N.W. Moravia]. Casopis pro mineralogii a geologii, 1956, **1**, 291, 1 pl.

Microelements of the Mn- and Mg-rich axinite of a contact zone in the limestone of Nedvědice are Ti, K, Na, Ba, and in less quantities Li, Cs, Rb, Ga, Sn, Cu, Sr, Zn, As, Mo, Tl, F, and Be.

F. S.

RUNNELS (RUSSELL T.), REED (ALBERT C.), & SCHLEICHER (JOHN A.). *Minor elements in Kansas salt.* Bull. Kansas Geol. Survey, 1952, **96**, 185-200, 1 pl.

Mine run salt (Permian Wellington formation of central Kansas) from three underground workings, raw brine, and some prepared salt products were examined spectrochemically for trace elements: Si, A, V, Ti, Mn, Cr, Cu, Sn, Pb, Zn, and Ag were identified. Minerals other than halite are anhydrite, celestite, and polyhalite. 29 spectr. anal., 18 chem. anal.

A. Sw.

BULLEN (K. E.). *Composition of the earth's outer core.* Nature, 1954, **174**, 505.

The latest information from revisions of the astronomical data indicates that, assuming the terrestrial planets have a common primitive composition, the earth's outer core is composed of a mixture of uncombined iron and of material the representative atomic number of which is smaller than that of iron.

D. J. S.

KRINSBY (D.). *Manganese in modern and fossil gastropod shells.* Nature, 1959, **183**, 770-771. C. H. K.

SCHLEICHER (JOHN A.) & HAMBLETON (WILLIAM W.). *Preliminary spectrographic investigation of germanium in Kansas coal.* Bull. Kansas Geol. Survey, 1954, **109**, 113-124, 2 figs.

A detailed spectrographic method for determining the germanium content of coal is described and analyses of 6 coals at 24 locations are reported. Concentration of germanium in the coal ash ranges from 0.0036 to 0.0680%, and in the whole coal from 0.00069 to 0.00480%. [M.A. **13-348**] A. Sw.

GEIJER (PER). *Pre-Cambrian atmosphere: evidence from the Pre-Cambrian of Sweden.* Geochim. Cosmochim. Acta, 1956, **10**, 304-310, 1 fig.

Evidence from the quartz-banded haematite sedimentary ores from Sweden indicates that the earth possessed an oxidizing atmosphere 2000×10^6 years ago. J. R. B.

HUFF (LYMAN C.). *A Paleozoic geochemical anomaly near Jerome, Arizona.* Bull. U.S. Geol. Survey, 1955, **1000-C**, 105-118.

Abnormal Cu (100 p.p.m.) and Zn (100 p.p.m.) content of a sandstone represents ore metal eroded from a nearby ore

deposit and incorporated in the sand during deposition. Elsewhere the same formation contains 20 p.p.m. Cu. Abnormal Pb concentrations are limited to the immediate vicinity of the ore bodies.

K. S.

CANNON (HELEN L.). *Geochemical relations of zinc-bearing peat to the Lockport dolomite, Orleans County, New York.* Bull. U.S. Geol. Survey, 1955, **1000-D**, 119-185.

Excessive amounts of Zn in peat soils have induced yellowing between the veins of leaves and dwarfing of the plants. Except for a few tolerant species, excessive amounts of zinc have caused plants to die. Excessive amounts of Pb are stored in the roots of plants. The peat soils contain as much as 16% zinc.

K. S.

HARBAUGH (JOHN W.). *Geochemical prospecting abstracts through June 1952.* Bull. U.S. Geol. Survey, 1953, **1000-A**, 1-46.

K. S.

ERIKSON (JANE EBNER). *Geochemical prospecting abstracts, July 1952-December 1954.* Bull. U.S. Geol. Survey, 1957, **1000-G**, 357-395.

K. S.

KENNEDY (VANCE C.). *Geochemical studies in the southwestern Wisconsin zinc-lead area.* Bull. U.S. Geol. Survey, 1956, **1000-E**, 187-223.

Unweathered rock and undisturbed residuum in the vicinity of known Pb- and Zn-deposits contain anomalously high concentrations of these elements. Streams draining areas with Pb- and Zn-minerals contain unusually high quantities of heavy metals (mainly zinc) in solution. K. S.

HAWKES (H. E.). *Geochemical prospecting investigations in the Nyeba lead-zinc district, Nigeria.* Bull. U.S. Geol. Survey, 1954, **1000-B**, 51-101.

MINERAL DATA

VAN VALKENBURG (A.) & RYNDERS (G. F.). *Synthetic cuspidine.* Amer. Min., 1958, **43**, 1195-1202, 3 figs., 3 tables.

Synthetic cuspidine, $3\text{CaO} \cdot 2\text{SiO}_2 \cdot \text{CaF}_2$, is monoclinic, optically positive, with $\alpha 1.591$, $\beta 1.596$, $\gamma 1.602$ (all ± 0.003) and $c : \gamma 7^\circ$; sp. gr. is 3.05. It can be synthesized hydrothermally, from crystallizing melts, and by solid state reactions. It melts congruently at $1410 \pm 10^\circ\text{C}$ at atmospheric pressure. Hydroxyl ion could not be substituted for fluoride ion, suggesting that eusterite, $3\text{CaO} \cdot 2\text{SiO}_2 \cdot \text{Ca}(\text{F},\text{OH})_2$ may not exist as a mineral. On prolonged heating at 1200°C in air cuspidine alters to $\gamma 2\text{CaO} \cdot \text{SiO}_2$ with loss of SiF_4 . X-ray powder data, a differential thermal curve, and an infrared spectrogram are given for synthetic cuspidine. [M.M. **28**-90]

B. H. B.

A field study of the distribution of traces of Pb and Zn in weathering products, particularly residual and alluvial soils, was made in order to determine whether geochemical methods of prospecting apply in a tropical environment equally well as in an environment of temperate climate. The program of detailed studies of the distribution of Pb and Zn in residual and alluvial cover over known lodes was followed by experimental reconnaissance sampling surveys to determine the feasibility of large-scale geochemical prospecting. The metal content of small near-surface samples of residual soil collected at a spacing of 100 feet varies enough to locate the important Pb-Zn lodes in the district. The metal content of deeper samples of alluvial soils collected at a spacing not greater than the width of the lode indicates sulphides beneath alluvial cover. K. S.

MIESCH (ALFRED T.) & NOLAN (THOMAS B.). *Geochemical prospecting studies in the Bullwhacker mine area, Eureka district, Nevada.* Bull. U.S. Geol. Survey, 1958, **1000-H**, 397-408.

Investigation of the distribution of lead, zinc, and arsenic in soils of the Bullwhacker mine area, indicates dispersion patterns of these three metals in residual soils over near-surface ore at the mine. Ore at greater depth in the shaft of the T. L. mine, however, is not reflected in lead, zinc, and arsenic contents of the soils. The dispersion patterns are secondary residual soil anomalies in the classification given by H. E. Hawkes. (Author's abstract.) [See preceding abstract.]

K. S.

CARLISLE (DONALD) & CLEVELAND (GEORGE B.). *Plants as a guide to mineralization.* California Div. Mines Spec. Rept., 1958, **50**, 31 pp. Price 50 cents.

Two of three known molybdenum deposits showed agreement between biogeochemical prospecting methods and geology.

K. S.

LINDBERG (MARIE LOUISE). *The beryllium content of roscherite from the Sapucaia pegmatite mine, Minas Gerais, Brazil, and from other localities.* Amer. Min., 1958, **43**, 824-838, 4 figs.

New spectrographic and chemical data for roscherite from the Sapucaia pegmatite mine, from the Nevel Quarry at Newry, Maine, and from the type locality at Greifenstein, Saxony, show that roscherite is a beryllium mineral with the formula $(\text{Ca},\text{Mn},\text{Fe})_3\text{Be}_3(\text{PO}_4)_3(\text{OH})_3 \cdot 2\text{H}_2\text{O}$. The known substitution ranges from $\text{Ca}_{4.45}\text{Mn}_{4.45}\text{Fe}_{3.1}$ (Greifenstein) to $\text{Ca}_{4.0}\text{Mn}_{2.7}\text{Fe}_{5.3}$ (Newry), and to $\text{Ca}_{3.0}\text{Mn}_{3.2}\text{Fe}_{5.8}$ (Sapucaia pegmatite mine). In view of the morphology the most probable space group, as derived from single crystal X-ray patterns, is C_{2h}^6-C2/c . Cell dimensions are $a 15.95$, $b 11.95$,

c 6.62 Å, β 94° 50' (Sapucaia pegmatite mine), and a 15.88, b 11.90, c 6.66 Å, β 95° 42' (Greifenstein); $Z=4$. Among the 9 forms observed on roscherite crystals from Brazil {100}, {111}, and {010} are dominant. An angle table based on X-ray data is given. Due to inadequacy of the original description a reconciliation with the former crystallographic setting could not be achieved. Indexed X-ray powder diffraction patterns for roscherite from all 3 localities are tabulated. The roscherite from Brazil is yellow, refractive indices are α 1.636, β 1.641, γ 1.651, dispersion $r > v$. It occurs as single crystals or aggregates and as crusts in vugs in muscovite. It is associated with the phosphates faheyite, frondelite, and variscite and with beryl and euhedral crystals of quartz.

A. P.

GLASS (JEWELL J.), EVANS (HOWARD T., Jr.), CARRON (M. K.), & HILDEBRAND (F. A.). Cerite from Mountain Pass, San Bernardino County, California. Amer. Min., 1958, **43**, 460-475, 4 figs.

The earlier description of cerite from Mountain Pass, California [M.A. **13**-373] has been amplified and corrected. The cerite occurs with bastnaesite, barite, quartz, chalcedony, calcite, galena, and altered acmite in a mineralized zone in shonkinitic in an area of Precambrian metamorphic rocks. It is verona brown and occurs in massive form and in crystals. The crystals are pseudo-octahedral and range in size from 2 to 7 mm. The mineral has resinous lustre, hardness above 5, and no observable cleavage. It gelatinizes in hot acid. The sp. gr. is 4.78 ± 0.11 (Berman balance). Cerite is uniaxial positive, $\omega = 1.806$ and $e = 1.808$. Single crystal X-ray study shows it to be rhombohedral, space group $D_{3d}^6 \cdot R\bar{3}c$ or $D_{3v}^6 \cdot R3c$, hexagonal cell dimensions $a = 10.78 \pm 0.08$, $c = 38.03 \pm 0.27$ Å. Crystal forms present are c {0001}, e {0112}. The tentative formula $(Ca, Mg)_2(Re)_8 \cdot (SiO_4)_{7-x}(FCO_3)_x(OH)_x(H_2O)_{3-x}$ is proposed. Indexed powder diffraction patterns are reported for cerite and for bastnaesite.

A. P.

KATO (T.). A study on monazite from the Ebisu mine, Gifu prefecture. Min. Journ. [Japan], 1958, **2**, 224-235, 2 figs.

Monazite occurs as small yellowish to dark brown grains disseminated in a quartz vein with wolframite and bismuth minerals at the Ebisu mine, Wada, Hirukawa village, Ena county, Gifu prefecture, and has H.5, and sp.gr. 5.20; α 1.790, β 1.791, γ 1.840, 2V, 10°. Chemical analyses by T. Kato are given for the Ebisu monazite, A, and for monazites from Ratunapura, Ceylon, B, and Minas Gerais, Brazil, C, together with an outline of the analytical procedure used. Results are also given of X-ray fluorometric analysis of the rare earths in monazite from several localities, and X-ray powder data are tabulated for six specimens; no systematic relation-

ship was detected between the cell dimensions and the T content. The isotopic composition of the lead isolated from the Ebisu specimen is given and from the Th/ ^{208}Pb ratio the age is taken to be about 50 m.y.

	SiO ₂	Al ₂ O ₃	ThO ₂	U ₃ O ₈	Ce ₂ O ₃	La ₂ O ₃ &c.	Fe ₂ O ₃	CaO
A	2.24	0.36	4.51	0.21	24.58	38.51	0.48	0.86
B	2.46	0.43	14.52	0.32	22.95	30.56	0.93	0.82
C	1.18	1.08	5.37	tr.	28.43	32.49	2.88	0.02
	PbO	P ₂ O ₅	ign. loss	Total	$a(\text{\AA})$	$b(\text{\AA})$	$c(\text{\AA})$	β
A	0.026	26.81	0.91	99.49	6.820	7.003	6.480	103° 39'
B	0.20	26.84	0.35	100.37	6.843	7.041	6.506	103° 43'
C	0.09	28.57	0.46	100.57	6.782	6.920	6.508	103° 45'

[M.A. **2**-36]

R. A. H.

[ОНТОЕВ (Д. О.)] Онтоев (Д. О.). О составе некоторых рудообразующих турмалинов. [On the composition of certain ore-forming tourmalines.] Труды института геологии и геохимии. [Trans. Inst. Geol. Ore-deposits, Petrog. Miner., Geochem.], 1956, no. **3**, 340-346. 4 figs.

Black, brown, and colourless tourmalines, from Siberian tin-bearing veins, are described. Three chemical analyses, optical and spectroscopic data are given, and the relation between physical properties and chemical composition is discussed. A. Colourless tourmaline, from carbonaceous shales and coals; B. Brown tourmaline, from a quartz-tourmaline vein; C. Black tourmaline, from a tourmaline nest in a coarse-grained porphyritic granite:

	SiO ₃	TiO ₂	B ₂ O ₃	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO
A	35.25	0.24	9.52	34.66	n.d.	8.42	—	4.73	0.97
B	34.99	0.67	9.86	35.15	0.98	10.33	0.03	3.11	0.76
C	35.02	0.06	9.03	31.68	n.d.	16.39	0.73	0.85	0.40
	Na ₂ O	K ₂ O	H ₂ O+	H ₂ O-	F	Total	ω	ϵ	
A	2.03	0.70	3.48	—	—	100.00	1.632	1.648	
B	0.79	0.55	2.38	0.07	—	99.67	1.629	1.654	
C	2.66	0.90	2.90	—	0.09	100.67	1.642	1.662	(-0.004)

S. I. T.

[ПОЛЯКОВА (О. П.)] Полякова (О. П.). О франкеите из оловянно-полиметаллических руд Смирновского месторождения (Восточное Забайкалье). [On franckeite from the tin-polymetallic ores of the Smirnovsky deposit (eastern Transbaikal region).] Труды Минер. Муз. Акад. Наук СССР [Trans. Min. Mus. Acad. Sci. U.S.S.R.], 1957, **8**, 103-107, 3 pls.

A description and a chemical analysis of franckeite are given. The analysis gave: Pb 49.25, Fe 3.42, Sn 15.88, Sb 10.62, S 20.90, = 100.21.

S. I. T.

HOWIE (R. A.) & BROADHURST (F. M.). X-ray data for dolomite and ankerite. Amer. Min., 1958, **43**, 1210-1213, 2 tables.

X-ray diffractometer powder patterns were made of two analysed carbonates: dolomite from Haley, Ontario and

nkerite from Oldham, Lancashire. X-ray data are tabulated; the cell parameters are:

	$a(\text{\AA})$	$c(\text{\AA})$	c/a	$a_{rh}(\text{\AA})$	α
olomite ($\approx \text{CaMg}(\text{CO}_3)_2$)	4.810	16.02	3.330	6.020	$47^\circ 07'$
nkerite ($\approx \text{Ca}_2(\text{Mg}_2\text{Fe})(\text{CO}_3)_6$)	4.819	16.10	3.341	6.045	$47^\circ 00'$

B. H. B.

McCONNELL (DUNCAN) & MURDOCH (JOSEPH). *The crystal chemistry of scawtite*. Amer. Min., 1958, **43**, 498–502.

A new analysis of scawtite from Crestmore, California, by Goldich and Ingamells gives CaO 46.93, SiO₂ 41.95, CO₂ 5.6, H₂O 4.96, MgO 0.16, Al₂O₃ 0.14, total iron as Fe₂O₃ 0.07, MnO 0.01, TiO₂ 0.01; 0.06 of total water is below 105°C; P₂O₅ absent or small, Na₂O and K₂O each less than 0.1%. On the basis of the cell content indicated by the three available analyses the formula for one unit cell, Ca₁₄(OH)₄Si_{16-x-y}C_{4x/3}H_{4y}O₄₄, is proposed.

A. P.

MURAOKA (H.), MINATO (H.), TAKANO (Y.), & OKAMATO (Y.). *Sepiolite from Yoshikawa-mura, Fukuoka Prefecture*. Journ. Min. Soc. Japan, 1958, **3**, 381–387 [in Japanese; English abstr., Min. Journ. (Japan), 1958, **2**, 279].

White, fibrous, wax-like sepiolite occurs as an alteration product in serpentine from Dondon, Wakita, Yoshikawamura, and has α 1.518, γ 1.528. Chemical analysis by H. Muraoka gave SiO₂ 49.42, TiO₂ nil, Al₂O₃ tr., Fe₂O₃ 0.03, FeO 0.42, NiO 0.06, MnO nil, MgO 22.03, CaO tr., Na₂O + K₂O 0.12, H₂O⁺ 9.99, H₂O⁻ 18.49, = 100.56. R. A. H.

[KORZHINSKY (A. F.) & VASILIEV (E. K.)] Коржинский (А. Ф.) и Васильев (Е. К.). Нахodka паралюминита в юрских осадках юго-западной окраины вилойской впадины. [A find of paraluminite in the Jurassic deposits of the south-western border of the Viluy depression.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **123**, 357–360, 4 figs.

Paraluminite occurs embedded in clay in the form of small nodules of a compact white material which adheres to the tongue. Under the microscope one can observe aggregates of acicular crystals, α 1.463, β 1.411, extinction straight. Chemical analysis gave SiO₂ 0.78, TiO₂ trace, Al₂O₃ 36.37, Fe₂O₃ 0.26, FeO abs., MnO abs., CaO 0.23, MgO 0.18, P₂O₅ 0.04, SO₃ 14.56, H₂O 48.03, = ‘100.55’, corresponding to Al₄(OH)₁₀SO₄·10H₂O. D.t.a. shows two endothermal effects at 50–200°C and 840–885°C. The X-ray data are also given.

S. I. T.

[KUDRIASHOVA (V.I.)] Кудряшова (В.И.). Гиролит из эфузивных траппов среднего течения р. Нижней Тунгуски. [Gyrolite from effusive traps in the middle reach of the Lower Tunguska river.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **123**, 538–541, 2 figs.

Gyrolite is found in amygdalites and in veinlets in tholeiitic basalt lava belonging to the ‘Siberian traps’ formation. It occurs as white radial aggregates, α 1.537, β = γ 1.545, 2V(–) $10^\circ \pm 2^\circ$. Chemical analysis gave SiO₂ 52.97, Al₂O₃ 1.01, Fe₂O₃ 0.04, MgO 0.12, CaO 32.90, Na₂O 0.47, H₂O⁺ 8.29, H₂O⁻ 4.24, = 100.04. D.t.a. suggests the loss of 2/3 of the water at 150–250°C and the remainder at 740–780°C. An exothermal peak at 870°C probably indicates the formation of a new crystalline phase. [M.M. 30–450]

S. I. T.

GARD (J. A.) & TAYLOR (H. F. W.). *Foshagite: composition, unit cell and dehydration*. Amer. Min., 1958, **43**, 1–15, 9 figs.

Foshagite is confirmed as a mineral species. A new analysis gives the composition 4CaO·3SiO₂·H₂O; the ionic constitution is probably Ca₄Si₃O₉(OH)₂, with infinite metasilicate chains similar to those of wollastonite. The unit cell has been determined by a combination of single-crystal electron diffraction and oriented fibre X-ray methods; it is A-centered monoclinic with a 10.32, b 7.36, c 14.07 Å, β 106.4°, Z = 4. The crystals are markedly fibrous with length b , and principal cleavage (001). Reflections with k odd are weak and diffuse, and the pseudo-cell is primitive monoclinic with a 10.32, b 3.68, c 7.04, β 106.4°. Foshagite is dehydrated at about 700°C when it undergoes transformation to β -CaSiO₃ and β -Ca₂SiO₄. [M.A. 14–179]

A. P.

HUTTON (C. OSBORNE). *Notes on tapiolite, with special reference to tapiolite from southern Westland, New Zealand*. Amer. Min., 1958, **43**, 112–119.

An occurrence of rare particles of the multiple oxide tapiolite in beach sands near Otorokua Point, southern Westland, New Zealand, is recorded. For this mineral the following data have been determined: ω_{Na} 2.33 ± 0.01 , ϵ_{Na} 2.53 ± 0.04 , ω pale brown, ϵ reddish-brown to opaque; sp. gr. at 21°C 7.65. X-ray diffraction powder patterns show that the mineral has trirutile structure with unit cell dimensions a = 4.750, c = 9.208 Å and with d -spacings and intensities comparable to those recorded for analyzed tapiolite from Brazil and Morocco, but distinct from the pattern yielded by unheated tapiolite from Skogsbole, Finland. The tapiolite from the latter occurrence is shown to have rutile structure but, after heat-treatment, a trirutile structure is developed with resultant denser packing of atoms. The cell dimensions for ordered and disordered Skogsbole tapiolite, determined from quartz-calibrated Weissenberg films, are a 4.752, c 9.204 Å, and a 4.753, c 3.092 respectively.

A. P.

NEW MINERALS

ŽÁK (LUBOR) & SYNEČEK (VLADIMÍR). *Kettnerit* $CaFBiOCO_3$, novy nerost ze skupiny fosgenit-bismutitové. [Kettnerite, $CaFBiOCO_3$, new mineral of the phosgenite-bismutite group.] Časopis pro mineralogii a geologii, 1956, 1, 195–196. (Russian and English summaries.)

On quartz crystals from Dolní Krupka in the Ore Mts., more seldom on fluorite, yellow or yellowish-brown grains occur, together with bismuth and bismuthine in quartz-topaz-Li-mica veins. Structure analysis has shown ditetragonal-dipyramidal symmetry with a 3·79, c 13·59 Å, sp. gr. = 5·80. Named in honor of Radim Kettner, professor of geology, Charles University. [A.M. 42–121; M.M. 31–963]

F. S.

[SEmenov (E. I.), KAZAKOVA (M. E.), & SIMONOV (V. I.)] Семенов (Е. И.), Казакова (М. Е.) и Симонов (В. И.).

Новый циркониевый минерал сейдозерит и другие минералы группы вёлерита в щелочных пегматитах. [A new zircon mineral seidozerite and other minerals of the wöhlerite group in alkali pegmatites.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, 87 590–597, 1 fig.

Seidozerite is the name given to a new mineral found in the region of Lake Seidozero, Lovozero Tundra, Kola peninsula. It occurs as fan-line clusters of acicular crystals embedded in microcline in an alkali pegmatite. It resembles lamprophyllite. It is brownish red in colour (small needles are reddish yellow), semi-transparent, with vitreous lustre, brittle, has a perfect cleavage ||(001), H. 4–5, sp. gr. 3·472; is easily fusible b.b., soluble with difficulty in HCl; monoclinic with a 5·53, b 7·10, c 18·30 Å, β 102° 43', space group $C_{2h}^3 = Pc$ or $C_{2h}^4 = P2/c$; biaxial, positive, α 1·725, β 1·758, γ 1·830, $2V_\gamma$ 68°, O.A.P. || (001), dispersion of optic axes strong, pleochroism strong α dark red, β red, γ pale yellow. Chemical analysis gave SiO_2 31·40, ZrO_2 23·14, TiO_2 13·16, Nb_2O_5 0·60, Al_2O_3 1·38, Fe_2O_3 2·85, FeO 1·06, MnO 4·22, MgO 1·79, CaO 2·80, Na_2O 14·55, H_2O 0·60, F 3·56, = 101·11, less O for F 1·49, = 99·62. The corresponding formula is $Na_8Zr_3Ti_3Mn_2(Si_8O_{32}F_4)$. Besides seidozerite the pegmatites contain titan-lävenite [M.M. 26–342] which, as well as other minerals of the wöhlerite group, is discussed. [M.A. 14–178; A.M. 44–467, 910]

S. I. T.

THOMPSON (M. E.), ROACH (C. H.), & MEYROWITZ (ROBERT). *Simplotite, a new quadrivalent vanadium mineral from the Colorado Plateau.* Amer. Min., 1958, 43, 16–24, 3 figs.

Simplotite is a new calcium tetravanadite that has been found in five vanadium-uranium mines on the Colorado Plateau. It occurs as dark-green micaceous plates and as

hemispherical aggregates of plates, coating surfaces in sandstone impregnated by relatively unoxidized vanadium and uranium minerals. Simplotite is biaxial negative, $2V$ about 25°, dispersion $r > v$, weak and crossed, α 1·705 ± 0·003, β 1·767 ± 0·002, γ 1·769 ± 0·002; $\alpha = b$ yellow, β green, γ yellow-green. A chemical analysis of material from the Peanut mine, Montrose County, Colorado, gave CaO 11·4, V_2O_4 67·7, V_2O_5 0·5, H_2O 18·4, insol. 0·5, = 98·7. Simplotite is monoclinic, pseudotetragonal; space group $A2/m$, Am , c $A2$; a 8·39 ± 0·03, b 17·02 ± 0·05, c 8·37 ± 0·03 Å, β 90° 25' 5'; cell contents 4($CaV_4O_9 \cdot 5H_2O$); sp. gr. (meas.) 2·64 ± 0·03 (calc.) 2·65.

A. P.

KOUVO (OLAVI) & VUORELAINEN (YRJÖ). *Eskolaite, a new chromium mineral.* Amer. Min., 1958, 43, 1098–1106, 3 figs., 3 tables.

This new mineral, named after Pentti Eskola, was discovered at the Outokumpu copper mine in Finland. Its formula is $(Cr_{1.90}, V_{0.09}, Fe_{0.01})O_3$ from chemical analysis. Eskolaite is isostructural with Cr_2O_3 as determined by X-ray single crystal and powder studies. Indexed powder diffraction data are given for Cr_2O_3 , hematite, and eskolaite; crystal data for V_2O_3 , Cr_2O_3 , Fe_2O_3 , and eskolaite are also given. Chemical analysis by J. Kinnunen gave Cr_2O_3 94·13 ± 0·20, Fe_2O_3 0·55, V_2O_3 4·58, Al_2O_3 0·19, MgO 0·02, MnO 0·03, SiO_2 0·20, H_2O (total) 0·10, = 99·81; the amounts of oxides of Al, Mg, Mn, Si were estimated from spectrographic data. The crystal structure is of type $D5$, with space group $R\bar{3}c$. Tests with the common opaque mineral reagents are negative.

B. H. B.

MILTON (CHARLES) & CHAO (E. C. T.). *Eskolaite, Cr_2O_3 , in 'merumite' from British Guiana.* Amer. Min., 1958, 43, 1203.

Eskolaite, Cr_2O_3 , is a major constituent of black pebbles from the Merume River bed, British Guiana. The 'merumite' pebbles are a mixture of eskolaite and other chromium oxide minerals with quartz, pyrophyllite, and other minerals. Analyses of pebbles generally give 75% or more Cr_2O_3 , Al_2O_3 and H_2O each 7 to 8%, with SiO_2 , Fe_2O_3 , TiO_2 1 to 5% each, and V_2O_3 less than 0·2%. [M.M. 28–733]

B. H. B.

SCHALLER (W. T.) & VLISIDIS (A. C.). *Ajoite, a new hydrous aluminium copper silicate.* Amer. Min., 1958, 43, 1107–1111, 1 fig., 2 tables.

Ajoite, $Al_2O_3 \cdot 6CuO \cdot 10SiO_2 \cdot 5\frac{1}{2}H_2O$, is a new bluish green mineral from Ajo, Pima County, Arizona; its specific gravity is 2·96. Crystals are plates, flattened parallel to {010}, or laths elongated parallel to c ; most commonly

site is massive. It is biaxial positive with $\alpha = 1.565$, $\beta = 1.590$, $\gamma = 1.650$, $2V = 68^\circ$, $\alpha \parallel b$, $\gamma : c = 15^\circ$. The X-ray powder pattern is distinct from those of related minerals and the strongest lines are : 12·4(100), 3·34(25), 6·19(9), 4·12(9), 3·09(9). The analysis by A. C. Vlisdjis, deducting conichalcite and barite, is : SiO_2 45·90, CuO 32·98, FeO (total iron) 0·78, MnO 0·10, gO 0·66, CaO 0·34, Al_2O_3 7·30, TiO_2 0·16, H_2O — 2·55, $\text{H}_2\text{O} + 4·93$, $= 95·70$.

B. H. B.

ROSS (E. B.), COREY (A. S.), MITCHELL (R. S.), & WALENTA (KURT). *Heinrichite and metaheinrichite, hydrated barium uranyl arsenate minerals.* Amer. Min., 1958, **43**, 1134–1143, 3 figs., 7 tables.

Heinrichite, $\text{Ba}(\text{UO}_2)_2(\text{AsO}_4)_2 \cdot 10\text{--}12\text{H}_2\text{O}$, and metaheinrichite, $\text{Ba}(\text{UO}_2)_2(\text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$, occur as tabular, yellow to green fluorescent, transparent to translucent crystals. Both minerals are tetragonal and uniaxial negative, but may be anomalously biaxial with $2V$ up to 20° . Refractive indices are : heinrichite $\omega = 1.605$, $\epsilon = 1.573$ both ± 0.002 ; metaheinrichite $\omega = 1.637 \pm 0.001$, $\epsilon = 1.609 \pm 0.002$. X-ray powder data are given for both minerals ; single crystal data on metaheinrichite give $a = 7.07$, $c = 17.74 \text{ \AA}$ and $a : c = 1 : 2.509$, $Z = 2$, with the space group $P4_2$, $P4_2/m$, or $P4_222$. For metaheinrichite specific gravity is 4·04 (measured), 4·09 (calculated); micro-chemical analysis by R. Meyrowitz gave BaO 13·3, UO_3 52·5, As_2O_5 15·8, P_2O_5 2·4, PbO 0·9, CaO 0·1, CO_2 0·6, H_2O 12·2, insoluble 2·4, $= 100·2$. Both minerals have been found near Lakeview, Oregon, and in the Black Forest of Germany ; they are named after Professor E. William Heinrich.

B. H. B.

MURDOCH (JOSEPH). *Phosphate minerals of the Borborema pegmatites : II—Boqueirão.* Amer. Min., 1958, **43**, 1148–1156, 2 figs., 3 tables.

The Boqueirao is a zoned pegmatite of the heterogeneous type with the normal beryl-tantalite but contains some unusual minerals. Brief descriptions are given of the following : spodumene, lepidolite, tantalite, bismuth, uraninite, variscite, mitridatite, metastrengite, beraunite, rockbridgeite, manganite and cryptomelane, hureaulite, tavorite, stewartite, lithiophilite, and a new mineral (a hydrated calcium manganese phosphate) called chavesite. Chemical analyses are given for uraninite, lithiophilite, and metastrengite ; X-ray powder data are given for stewartite and chavesite. Chavesite has prismatic cleavage, $H.$ near 3 ; is triclinic with $\alpha = 1.60$, $\beta = 1.62$, $\gamma = 1.65$; multiply twinned with extinction about 30° to the twin plane ; $2V(+)$ large ; cell measurements give $a = 5.49$, $b = 13.07$, $c = 5.79 \text{ \AA}$ with angles $\alpha = 91^\circ 18\frac{1}{2}'$, $\beta = 108^\circ 3'$, $\gamma = 99^\circ 44'$, and $a : b : c = 1.4200 : 1 : 0.4438$. The powder pattern closely resembles that of monetite. Not enough material was available for a chemical analysis. [M.A. **13**–296]

B. H. B.

MURDOCH (JOSEPH) & CHALMERS (ROBERT A.). *Woodfordite, a new mineral from Crestmore, California.* Bull. Geol. Soc. America, 1958, **69**, 1620–1621 (abstract).

Woodfordite occurs as transparent, colourless crystals, associated with afwillite and calcite in veins cutting massive contact rock, in the Commercial Quarry, Crestmore, California. It forms hexagonal crystals, with $\{10\bar{1}0\}$, $\{0001\}$, $\{10\bar{1}2\}$, and $\{70\bar{7}8\}(?)$; perfect prismatic cleavage ; $H.$ $2\frac{1}{2}$; sp. gr. 1·85 ; optically negative, $\epsilon = 1.455$, $\omega = 1.465$; X-ray single crystal photographs gave $a = 22.32$, $c = 21.33 \text{ \AA}$, space group $P6_3$ or $P6_3/m$. Chemical analysis [not quoted] indicates a formula of approximately $2\text{Ca}(\text{SO}_4,\text{SiO}_3,\text{CO}_3)_2 \cdot 2\text{Ca}(\text{OH})_2 \cdot \text{Al}(\text{OH})_3 \cdot 7\text{H}_2\text{O}$; it is soluble in HCl, usually with slight effervescence. The name is for Professor A. O. Woodford who found the mineral. [A.M. **44**–465]

R. A. H.

CLARINGBULL (G. F.), HEY (M. H.), & DAVIS (R. J.). *Cornubite, a new mineral dimorphous with cornwallite.* Min. Mag., 1959, **32**, 1–5, 1 fig ; author's abstract, Min. Abstr., 1958, **13**, 558.

Apple-green patches of a new fibrous copper arsenate have been found on quartz coated with dark green cornwallite from Wheal Carpenter, Gwinear, Cornwall. An X-ray fibre photograph suggested a cell column of 228 \AA^3 or a simple multiple of this ; X-ray powder data are tabulated (strongest lines 4·72, 2·562, 2·489 \AA). Microchemical analysis on 6·6 mg gave CuO 59·86, As_2O_5 35·07, H_2O (by difference) 5·07, $= 100·00$, giving the formula $\text{Cu}_5(\text{AsO}_4)_2(\text{OH})_4$; sp. gr. 4·64. The new mineral is named cornubite from Cornubia, the medieval Latin name for Cornwall. It is dimorphous with cornwallite, and the cornwallite associated with the Wheal Carpenter cornubite had $a = 17.33$, $b = 5.82$, $c = 4.60 \text{ \AA}$, $\beta = 92^\circ 13'$ [M.A. **11**–425]. An analysis of this cornwallite gave CuO 60·29, As_2O_5 33·97, H_2O 5·80, insol. 0·82, $= 100·88$; sp. gr. 4·52. Cornubite is recorded also from four further localities in Cornwall, in a massive porcellaneous form variously associated with olivenite, liroconite, malachite, and cornwallite ; from Bedford United mines, Tavistock, Devon ; and from Potts Gill mine, Caldbeck, Cumberland.

R. A. H.

SAHAMMA (TH. G.) & HYTÖNEN (KAI). *Delhayelite, a new silicate from the Belgian Congo.* Min. Mag. 1959, **32**, 6–9, 1 fig.

A new silicate, delhayelite, occurs in the complex kali-silicate-bearing melilite-nephelinite lava from Mt. Shaheru, Nyiragongo area, North Kivu, Belgian Congo, together with götzenite and combeite [M.M. **31**–503 ; M.A. **14**–60] and kirschsteinite [M.M. **31**–698, M.A. **14**–140]. Single crystal X-ray photographs indicate that it is orthorhombic, possible space groups $Pmn2_1$ or $Pmmn$, with $a = 6.53$, $b = 24.65$, $c = 7.04 \text{ \AA}$, and a weak super-cell with doubled a -axis : indexed powder

data are tabulated. Delhayelite is colourless, with a distinct (010) cleavage; birefringence 0.002–0.003; $\alpha \approx \beta \approx \gamma$ 1.532; $2V_s$ 83°; orientation $a \parallel \alpha$, $b \parallel \gamma$, $c \parallel \beta$; sp. gr. 2.60. A chemical analysis by P. Ojanperä, after correction for admixed nepheline, gave SiO_2 52.60, TiO_2 0.09, Al_2O_3 9.22, Fe_2O_3 (total Fe) 2.72, MnO 0.07, MgO 1.03, CaO 7.99, Na_2O 3.20, K_2O 9.27, $\text{H}_2\text{O} + 5.93$, $\text{H}_2\text{O} - 3.35$, Cl 3.91, F 0.33, SO_3 1.31, less O for F and Cl 1.01, = 100.01, leading to the tentative formula $(\text{Na}, \text{K})_4\text{Ca}_5\text{Al}_6\text{Si}_{32}\text{O}_{80} \cdot 18\text{H}_2\text{O} \cdot 0.3(\text{Na}_2, \text{K}_2)(\text{Cl}_2, \text{F}_2, \text{SO}_4)$. The name is after the Belgian geologist F. Delhay. The mineral though representing a distinctly different species appears to be closely related to rhodesite. [M.M. 31–607, 611; M.A. 13–555, 14–140; A.M. 43–624] R. A. H.

JAGER (E.), NIGGLI (E.), & VAN DER VEEN (A. H.). *A hydrated barium-strontium pyrochlore in a biotite rock from Panda Hill, Tanganyika.* Min. Mag., 1959, **32**, 10–25, 8 figs.

PHYSICAL PROPERTIES OF MINERALS

BAUER (ERNEST). *Coupling of optic and acoustic modes of vibration in crystals.* Journ. Chem. Physics, 1957, **26**, 1440–1444.

The transition probability for transfer of energy from one optic to two or three acoustic modes of vibration has been calculated for sodium chloride, and found to be of the order of 10^{12} per sec. at low temperatures. R. A. H.

VERHOOGEN (JOHN). *Physical properties and bond type in Mg-Al oxides and silicates.* Amer. Min., 1958, **43**, 552–579.

From a study of physical properties that are sensitive to the electronic distribution, it is concluded that oxides and silicates of Mg and Al behave mostly as purely ionic compounds. Departures from ionic behaviour are generally not such as to suggest covalent bonding. A. P.

MITCHELL (E. W. J.) & PAIGE (E. G. S.). *The optical effects of radiation induced atomic damage in quartz.* Phil. Mag., 1956, ser. 8, **1**, 1085–1115, 16 figs.

Two absorption bands associated with atomic displacements in crystalline quartz have been found, at 5.7 eV and 7.6 eV. It is suggested that these are due to oxygen ion vacancies and interstitial oxygen ions which produce absorption bands after trapping electrons and holes respectively. All the damage is annealed by heating at 950°C. R. A. H.

MITCHELL (E. W. J.) & RIGDEN (J. D.). *The effects of radiation on the near infra-red absorption spectrum of α -quartz.* Phil. Mag., 1957, ser. 8, **2**, 941–956, 8 figs.

A hydrated barium-strontium pyrochlore with only subordinate amounts of Ca and Na occurs in a weathered biotite-bearing contact rock of the Mbeya carbonatite Panda Hill, south-western Tanganyika. It forms small euhedral yellowish grey cubic crystals with n 2.07–2.1 reflectivity 13.2%, H. 4½–5; poor {111} cleavage; sp. gr. 4.0. X-ray powder and single crystal photographs gave 10.562 Å, space group $O^7h-Fd3m$: the indexed powder data are tabulated. Chemical analysis after correction for impurities indicated a formula $(\text{Ba}_{0.30}\text{Sr}_{0.22}\text{Ca}_{0.05}\text{Ce}_{0.05}\text{Na}_{0.03}\text{Fe}_{0.02}\text{K}_{0.01}\text{Th}_{0.01})(\text{Nb}_{1.83}\text{Ta}_{0.004}\text{Ti}_{0.17})\text{O}_{5.61}(\text{H}_2\text{O})_{0.80}$. The d.t.a. curve shows an endothermic peak at 330°C and exothermic reactions at 540°, 800°, and 820°C: infra-red spectrophotometry did not indicate hydroxyl groups. The mineral is named pandaite after the Panda Hill locality.

R. A. H.

The variation of the absorption strength and spectrum in the region of 3μ has been determined for different specimens of crystalline quartz and for X-ray, electron, and pile irradiated crystals, and is shown to be associated with imperfections in the crystal.

R. A. H.

PAIGE (E. G. S.). *The kinetics of colour centre formation in quartz.* Phil. Mag., 1957, ser. 8, **2**, 864–876, 4 figs.

Using a model for crystalline quartz it is possible to explain radiation bleaching by both X-rays and neutrons by considering the dependence of the occupancy of one electron or hole trap on other traps. With the same model an explanation of the effect of heat treatment on the kinetics of colouration of quartz is given.

R. A. H.

WITTELS (M. C.). *Structural behaviour of neutron irradiated quartz.* Phil. Mag., 1957, ser. 8, **2**, 1445–1461, 7 figs. 1 pl.

Single crystals of quartz irradiated with less than 3×10^{19} neutrons/cm² expand anisotropically in a manner similar to the thermal expansion of unirradiated quartz. After doses in excess of 3×10^{19} neutrons/cm² the damaging is more complex since the volume change indicated by X-ray measurements of the host structure becomes larger than the bulk volume change measured hydrostatically. After 8×10^{19} neutrons/cm² the inhomogeneous shear strain induced by the large anisotropic expansions is seen in the extreme skewing of the 2240 reflection. Coesite [M.A. 13–485] remained stable under neutron irradiation doses which completely disorder quartz.

R. A. H.

ss (MANUEL N.). *Effects of gamma irradiation on physical properties of minerals.* Amer. Min., 1957, **42**, 100–104.

The density and optical properties of colourless, blue, blue-green and pink fluorite, halite, colourless quartz, lepidolite, rose quartz, epidote, allanite, muscovite, biotite, and lepidolite were measured before and after gamma irradiation. Except for difference in colour in the fluorite, halite, and quartz specimens of which details are given, significant differences were detected between irradiated and non-irradiated samples. [M.A. 11–488] R. A. H.

ERMAN (ROBERT). *Some physical properties of naturally irradiated fluorite.* Amer. Min., 1957, **42**, 191–203.

Five samples of purple fluorite found in association with radioactive materials and a synthetic colourless control sample were studied and compared before and after heating. In the order of increasing difference in physical properties from those of the control sample apparently represents increasing structural damage by radiation, and correlates with decreasing specific gravity, increasing refractive index, broadening of X-ray lines, and increasingly strong exothermic reactions on annealing which begins at 175°C. These phenomena are caused by nuclear particles disrupting the structure along their paths after which the material recrystallizes imperfectly, raising the temperature enables the sample to recrystallize with fewer strains. The intensity of structural damage cannot be used as a method of age determination, nor can the purple colouring be used as a geological thermometer. [M.M. 30–327; M.A. 7–136, 2–161, 185, 13–33, 128]

R. A. H.

GIARDINI (A. A.). *Stress-optical study of strontium titanate.*

Journ. Opt. Soc. Amer., 1957, **47**, 726–735.

The piezobirefringence of strontium titanate has been investigated, and this cubic synthetic material has been found to become an optically negative uniaxial crystal when stressed along a crystallographic axis, and an optically negative biaxial crystal when under a crystallographic diagonal stress.

R. A. H.

DENNING (R. M.), GIARDINI (A. A.), POINDEXTER (EDWARD), & SLAWSON (C. B.). *Piezobirefringence in diamond: further results.* Amer. Min., 1957, **42**, 556–563.

The almost isotropic nature of the piezobirefringence effect in diamond has been confirmed by studies on a specimen bounded by (100), (011), and (011) planes [M.A. 13–457]. The absolute values of the stress-optical constants have been determined approximately; they lead to a prediction of a decline in refr. ind. of a diamond subjected to uniform hydrostatic stress. [M.A. 11–482]

R. A. H.

GIARDINI (A. A.). *Piezobirefringence in silicon.* Amer. Min., 1958, **43**, 249–262, 6 figs., 2 tables.

The stress-induced birefringence in high purity silicon has been measured at the infrared wavelength of 1.11 μ. Silicon is opaque to wavelengths shorter than 1.05 μ. Values for the two piezobirefringence constants at the 1.11 μ wavelength are: for $(q_{1111}-q_{1122}) = -14.4 \times 10^{-14} \text{ cm}^2/\text{dyne}$, and for $2q_{1212} = -10.0 \times 10^{-14} \text{ cm}^2/\text{dyne}$; these are believed correct to ±2.5%. A linear relationship exists between the retardation and applied stress in the measurement of both constants, up to a stress of 450 kg/cm². Qualitative observations indicate that silicon becomes uniaxial negative under stress parallel to [100]. Instrumentation of the press, the infrared monochromator, and the infrared converter are described.

B. H. B.

CLARK (SYDNEY P., Jr.). *Absorption spectra of some silicates in the visible and near infrared.* Amer. Min., 1957, **42**, 732–742, 3 figs.

Absorption coefficients of olivine, diopside, and three varieties of garnet have been measured in the spectral range 0.3 to 4 microns. Olivine (peridot) from Burma with $\alpha 1.648$, $\beta 1.665$, $\gamma 1.686$, 2V, 85°, sp. gr. 3.31, $d_{130} 2.772 \text{ \AA}$, and diopside from Rotenkopf, Tyrol, with $\alpha 1.762$, $\beta 1.780$, $\gamma 1.702$, 2V, 60°, $\gamma:c 40^\circ$, sp. gr. 3.29, had absorption peaks at a wave number of about 10000 cm⁻¹. Almandine (I) from India had a strong peak at about 8000 cm⁻¹ and numerous weaker peaks, while a grossular-andradite garnet (II) from South Africa showed no strong peaks: analyses are by J. Ito. At wave numbers between 2000 and 7000 cm⁻¹ the absorption coefficient of olivine is less than 0.5 cm⁻¹ and that of diopside is about 1 cm⁻¹; these results support the hypothesis that radioactive transfer is important in the earth's mantle.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO
A	37.69	0.07	20.62	4.30	30.80	1.97	4.40
B	36.92	0.12	12.47	14.14	1.84	0.95	—
		CaO	H ₂ O —	Total	sp. gr.	n	a(Å)
A	—	—	0.36	100.21	4.16	1.807	11.52
B	33.63	—	0.57	100.64	3.71	1.801	11.94

R. A. H.

TAKÉUCHI (Y.). *Infrared absorption and structures of borate polyatomic ions.* Min. Journ. [Japan], 1958, **2**, 245–268, 15 figs.

The infra-red absorption spectra have been determined for powders of kotoite, ludwigite, pinakiolite, suanite, szájbelyite, sussexite, colemanite, lesserite, inderite, meyerhofferite, hilgardite, ulexite, priceite, probertite, kernite, pinnoite, and B₂O₃, in the range from 2 to 16 microns, and are figured here. The characteristic borate polyatomic ion spectra appear within the range 7 to 16 microns and are useful in the qualitative analysis of such materials. The structures and configurations of the borate polyatomic ions are discussed.

R. A. H.

BARNES (DAVID F.). *Infrared luminescence of minerals.* Bull. U.S. Geol. Survey, 1958, no. **1052-C**, 71-157.

About 1500 specimens, representing 75 distinct mineral species, emitted infrared radiation in a survey of the study collection in the U.S. National Museum (nearly 200,000 specimens). In most cases the strongest emissions result from visible light; approximate wavelengths of emission and excitation were determined by means of filters. Corundum, beryl, spinel, jadeite, and kyanite show very strong infrared luminescence. The rare earth elements are responsible for the long-wavelength emissions of many minerals including scheelite, fluorite, apatite, feldspar, and amphibole. A table (15 pp.) lists the mineral species alphabetically, their locality, and the strength of infrared luminescence; another (7 pp.) tabulates the abundance of infrared and visible luminescence in minerals; and a third (34 pp.) describes the characteristics of infrared luminescence in selected mineral specimens under the headings: color and intensity of visible fluorescence; infrared reflection; and strength, range of excitation, maximum of excitation, and emission wavelength of infrared luminescence. K. S.

LEWIS (D. R.). *The thermoluminescence of dolomite and calcite.* Journ. Physical Chem., 1956, **60**, 698-701, 4 figs.

The thermoluminescence glow curves of calcite and dolomite have characteristic peaks resulting from groupings of energy levels in the crystals which can be populated with metastable electrons by exposure of the minerals to cobalt-60 γ radiation. In the range dolomite-calcite the ratio of the glow curve peak heights varies regularly with the composition. Dolomite can also be distinguished from a mixture of calcite and magnesite by the temperature and height of the glow curve peaks. R. A. H.

[BARSANOV (G. P.) & SHEVELEVA (V. A.)] Барсанов (Г. П.) и Шевелева (В. А.). Материалы по изучению люминесценции минералов. V. Свободные атомы элементов и интерметаллические соединения. [Materials for the study of luminescence in minerals. V. Free atoms of the elements and intermetallic compounds.] Труды Минер. Муз. Акад. Наук СССР [Trans. Min. Mus. Acad. Sci. U.S.S.R.], 1957, **8**, 17-24.

Continuation of previous series [M.A. **13**-452]. Twenty-four native elements are discussed, especially diamond.

S. I. T.

[PONOMAREVA (M. N.)] Пономарева (М. Н.). К вопросу о зависимости отражательной способности рудных минералов от их структурных особенностей. [On the dependence of the reflecting capacity of ore minerals on their structural characters.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **121**, 162-164, 1 fig.

Relations between the indexes of reflection in air and cedar oil, the index of refraction, the coefficient of absorption, the bond type, and the structural type of a number of ore minerals are shown in a table and in a diagram, in which the vertical axis is the index of reflection in air, and the horizontal axis is the index of reflection in cedar oil.

S. I. T.

SHODA (T.). *Dependence of the optical absorption on the crystallographic orientation in heikolite.* Min. Journ. [Japan], 1956, **2**, 39-47, 6 figs.

For the variety of alkali amphibole heikolite [M.J. **28**-730] the principal axes of the absorption ellipsoid are oriented with X nearly perpendicular to (100), Y parallel to [010] and Z nearly parallel to [001]. The orientation of X and Z do not coincide with the principal axes of the indicatrix. The pleochroic scheme is α yellowish brown, β deep yellowish green, γ deep bluish green; absorption $\gamma > \beta \gg \alpha$. [M.J. **12**-595]

R. A. H.

SHODA (T.). *On probable elliptic vibration of light in heikolite.* Min. Journ. [Japan], 1957, **2**, 114-133, 14 figs., 2 pls.

The anomalous optical properties of heikolite are attributed to the elliptic vibration of light, resulting from the strong absorption of the mineral. Single crystal X-ray photographs indicated that only one phase was present. The cell parameters of this alkali amphibole are a 10.0 Å, b 18.0, c 5.33, β 106° 50'. [M.A. **12**-595]

R. A. H.

SHODA (T.). *Elliptic vibration of light in some alkali amphiboles.* Min. Journ. [Japan], 1958, **2**, 269-278, 8 figs.

The ellipticity of the vibration of light in arfvedsonite and riebeckite has been determined. The results obtained are similar to those previously reported for heikolite. [M.A. **4**-390, **12**-595, **13**-537, and preceding abstract]

R. A. H.

CHANDRASEKHAR (S.). *The optical rotatory dispersion of quartz.* Proc. Indian Acad. Sci., 1957, **45**, A, 147-166.

The entire range from visible to extreme ultraviolet is covered by a new formula $\rho = k\lambda^2/(\lambda^2 - \lambda_0^2)$ where $k = 7.11$ and $\lambda_0 = 0.0926283\mu$. A theoretical interpretation of the new formula is given on the basis of a simple coupled oscillator model.

R. A. H.

[POVARENYYKH (A. S.)] Поваренных (А. С.). О связи показателя преломления света с природой минералов [The connection of the index of refraction with the nature of minerals.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 348-359, 6 figs.

A detailed study of the relation of the index of refraction to other properties of minerals shows that it increases with

crease of the degree of covalent bonds, with increase of ionicity and coordination number, and, varying with variation in the structure of electron shells, with increase in compactness of the crystalline structure. S. I. T.

TRENS (L. H.). *Variation of refractive index with ionization potential in some isostructural crystals.* Min. Mag., 1958, **31**, 929–936, 2 figs.

It is assumed that polarization of the anion (usually O^- or F^-) makes the principal contribution to the total refractive index effect and that polarization of the anion is controlled largely by the field in which it finds itself. This in turn depends on the effective force of attraction of the cation, and ionization potentials are used for the purpose of comparing such forces. For compounds involving pairs of 10- and 18-electron cations or pairs of transition cations refractive indices are higher in the crystal that contains the cation of the element with the higher ionization potential. For medium-sized divalent cations of various types discrepancies sometimes observed in the relationship between ionization potential and refractive index may be due to the effect of the crystal field on certain 3d transition cations. I.A. **5**–208, **13**–197, 276, 533]

R. A. H.

RISHANAMURTI (D.). *The Raman spectrum of calcite and its interpretation.* Proc. Indian Acad. Sci., 1957, **46**, A, 183–202, 6 pls.

R. A. H.

SIMKIN (H. J.) & BOND (W. L.). *Elastic moduli of diamond.* Phys. Rev., 1957, **105**, 116–121.

The adiabatic elastic moduli of single crystals of diamond are $c_{11}=10.76$, $c_{12}=1.250$, $c_{44}=5.758 \times 10^{12}$ dynes/cm².

R. A. H.

POVARENNYKH (A. S.)] Повареных (А. С.). К вопросу о сжимаемости и термическом расширении минералов. [On compressibility and thermal expansion of minerals.] Труды Минер. Муз. Акад. Наук СССР [Trans. Min. Mus. Acad. Sci. U.S.S.R.], 1957, **8**, 85–98.

Data relating to compressibility and expansion of minerals are given and discussed. An attempt is made to correlate these properties with the structure of minerals. New tables of compressibility and expansion of minerals are devised.

S. I. T.

USTIN (J. B.). *The coefficient of linear thermal expansion of tridymite.* Journ. Amer. Chem. Soc., 1954, **76**, 6019–6020.

The coefficient of linear thermal expansion for three

specimens of low-temperature tridymite was $23\text{--}26 \times 10^{-6}$, for the intermediate form it was 45×10^{-6} , and for the high temperature form it was $45\text{--}65 \times 10^{-6}$; inversions took place at 117° and 163° , both $\pm 1^\circ$. A further change in the expansion coefficient took place at 210° (believed to correspond to the third transition recorded at 223° by Moseman and Pitzer, 1941) and a further smaller change took place at 475°C .

R. A. H.

HEARMON (R. F. S.). *The elastic constants of anisotropic materials. II.* Advances in Phys., 1956, **5**, 323–382, 6 figs.

A summary of work on the elastic constants mainly of crystalline materials including diamond, fluorite, galena, garnet [almandine], magnetite, pyrite, sphalerite, apatite, beryl, β -quartz, zircon, rutile, corundum, calcite, tourmaline, baryte, and celestine.

R. A. H.

PATERSON (M. S.). *Experimental deformation and faulting in Wombeyan marble.* Bull. Geol. Soc. Amer., 1958, **69**, 465–476, 8 figs.

The results of compressive stress-strain tests on a coarse-grained marble (average grain size about 1 mm) at various confining pressures up to 1000 kg/cm² are given. Special attention is paid to the transition from brittle to ductile behaviour. At low confining pressures well defined shear fractures developed rather than the longitudinal fractures characteristic of failure at atmospheric pressure. A. L. A.

DE SITTER (L. U.). *The strain of rock in mountain-building processes.* Amer. Journ. Sci., 1956, **254**, 585–604.

The interval between the stress level and the elasticity limit appears to be the most important factor in the different types of folding. This interval will increase either because of a fall in the resistance of the rocks or because of a rise in the stress. The two principal types of folding are concentric folding, a typical elastico-viscous kind of strain in which this interval is small, and cleavage folding, in which it is greater. An analogy to these two types of folding can be found in the para- and ortho-tectonic types of orogenesis.

[M.A. **8**–68, 277]

R. A. H.

DEADMORE (D. L.) & MACHIN (J. S.). *Some plastic properties of pastes made from hydrated dolomitic and high-calcium limes.* Illinois State Geological Survey, 1958, Circ. **261**, 9 pp., 7 figs., 2 pls.

Four commercial hydrated limes were studied. Two from Northwestern Ohio were partially hydrated dolomitic varieties that gave instantaneous Emley plasticity values

of about 120. After soaking, the Emley values increased to about 310. The third line was a high-calcium hydrate and had a plasticity of about 100, both immediately before and after soaking. The fourth line was a highly hydrated dolomitic type; its immediate plasticity was 274 and, after soaking, reached 340. A study of particle-size distribution data and X-ray diffraction analysis show that the differences in the observed plasticities are correlated with high $Mg(OH)_2$ content and high relative amounts of fine particles.

J. Ph.

BUTKOVICH (T. R.). *Hardness of single ice crystals*. Amer. Min., 1958, **43**, 48–57, 9 figs.

Brinell and scratch hardness tests were made on single ice crystals. Brinell hardness numbers range from 4 at $-5^{\circ}C$ to 17 at $-50^{\circ}C$, the greatest increase in the hardness values occurring at the higher temperatures. Temperature dependence of scratch hardness is similar to that of Brinell hardness. The single ice-crystal is harder parallel to the *c*-axis than in the direction normal to *c*.

A. P.

GIARDINI (A. A.). *A study of the directional hardness in silicon*. Amer. Min., 1958, **43**, 957–969, 4 figs.

The directional hardness of single crystal silicon has been investigated both by a method of peripheral grinding on oriented thin circular specimens and by knoop microindentations. Grinding hardness has been evaluated in the principal zones [100], [110], and [111]. Knoop hardness numbers are given for planes (100), (110), and (111) with indentations extended over 90° azimuths. The results are compared with published data for diamond which has the same crystal structure.

A. P.

ALBRECHT (F.). *Zur Härte-Anisotropie des synthetischen Korunds*. Zeits. Krist., 1954, **106**, 183–190, 3 figs.

In synthetic corundum the resistance to grinding varies considerably in different crystallographic directions. The first effect of the addition of red colouring oxide is to increase the resistance to grinding and the hardness; if too much colouring oxide is added the strength decreases again.

R. A. H.

EPPLER (W. F.). *Details of hardness*. Journ. Gemmology, 1956, **5**, 243–256.

Following a discussion of the nature of hardness, with its attendant factors of plasticity, elasticity, brittleness, and toughness, various methods for testing hardness are reviewed. These can be classed as static (indentation methods of several kinds), and dynamic, which includes the classical

methods of scratching and grinding. Other dynamic methods are the pendulum method (Herbert, 1923) and impact abrasion method (Ridgway, 1933). The last is very sensitive, and has, for example, revealed great difference in hardness on single-crystal surfaces of synthetic corundum.

B. W. A.

STOTT (P. M.) & STACEY (F. D.). *Magnetostriction and palaeomagnetism of igneous rocks*. Nature, 1959, **182**, 384–385.

Laboratory experimental evidence showed that large systematic errors due to magnetostriction are unlikely in igneous rocks of the types normally used for palaeomagnetic work.

M. J. Le B.

EINARSSON (T.). *Der Paläomagnetismus der isländischen Basalte und seine stratigraphische Bedeutung*. Neues Jahrb. Geol. Pal., Montashefte, 1957, 159–175, 6 figs.

The thermo-remanent magnetization of basalts is substantially constant for geological periods of time. In France, Iceland, and Japan the magnetic field of the earth deduced from thermo-remanent magnetization continued normally, that is with magnetic south pole near the geographical north pole as at present, well into the Pleistocene; during the lowest Quaternary and Villefranchian it was reverse. In Iceland 30 alterations of field direction during the Tertiary have already been established. [M.A. 14–143] J. Ph.

EINARSSON (T.). *Über den Wert alter Sedimente für paläomagnetische Zwecke*. Neues Jahrb. Geol. Pal., Monatshefte, 1957, 193–195.

The natural magnetization of ancient red sediments could be substantially affected by tectonic stress. On the other hand basaltic lavas may afford reliable palaeomagnetic material and deserve special attention.

J. Ph.

CREER (K. M.). *Preliminary palaeomagnetic measurements from South America*. Ann. Géophysique, 1958, **14**, 373–390, 12 figs.

Measurements of the natural remanent magnetization of basalts of Quaternary age (Argentine) and early Jurassic age (Uruguay-Brazil border) show normal and reversed groups of magnetization. Sediments interbedded with the early Jurassic flows also show the normal and reversed groups. The lavas are 'cleaned' of secondary components of magnetization by treatment in alternating fields; the thermo-remanent magnetization acquired on cooling through the Curie temperature is believed to have been unaffected by the process.

J. Ph.

ROCK-FORMING MINERALS AND PETROLOGY

Rock-forming minerals

MEC (DUSÁN). *Vznik mikrografických srůstů krémene a mikroklinu v javornickém granodioritu.* (*The origin of micrographic intergrowths of microcline and quartz in the granodiorite of Javorník.*) Casopis pro mineralogii a geologii, 1956, **1**, 242–246, 3 figs. (Russian and English summaries.)

In thin sections of granodiorite from Javorník in Czechoslovakia, plagioclase is often overgrown by microcline which intergrown with uniformly orientated quartz [M.A. 12–5]. These peripheral growths are related to the orientation of the core plagioclase, and growth of the two minerals in rims is probably simultaneous.

F. S.

MISAKA (T.), HENMI (K.), & SHIBUYA (G.). *On the growth relations of orthoclase and adularia from Banda, Tōji-Machi, Okayama Prefecture.* Journ. Min. Soc. Japan, 1956, **3**, 39–48.

Crystals of orthoclase overgrown with adularia in a pegmatite in biotite granite commonly occur as Baveno or Manebach twins elongated along [100], the overgrowing adularia having its characteristic habit. The composition of the orthoclase was determined as $\text{Or}_{65}\text{Ab}_{33}\text{An}_2$ and that of the adularia as $\text{Or}_{88}\text{Ab}_{11}\text{An}_3$. Because of the probable gap temperatures of crystallization inferred from the difference in composition, and the sharp boundary between the two varieties, it is inferred that hydrothermal solutions ascended to the pegmatite after its solidification and deposited the adularia.

R. A. H.

MITH (J. V.) & MACKENZIE (W. S.). *The alkali feldspars: IV. The cooling history of high-temperature sodium-rich feldspars.* Amer. Min., 1958, **43**, 872–889, 8 figs.

A redetermination of part of the alkali feldspar solvus has been made using single crystal X-ray methods to obtain the composition of the Na-rich phase of a natural cryptoperthite subjected to various heat treatments. This solvus differs considerably from that determined by Bowen and Tuttle [M.A. 11–325] for synthetic feldspars. The discrepancy is believed to be due to errors in determination of composition of separate phases from powder patterns and to metastability of the synthetic feldspars in the temperature range of the solvus. Single crystal X-ray photographs of some natural Na-rich high-temperature alkali feldspars revealed several different orientations for the twinned components and the perthitic units of unmixed crystals. Interpretation of the X-ray photographs in the light of the position of the monoclinic-triclinic inversion and the revised position of the solvus has given information on the cooling history of these specimens.

A. P.

SUENO (T.). *Frequency distribution of the composition of plagioclases in some igneous rocks.* Min. Journ. [Japan], 1956, **2**, 48–58, 3 figs.

The frequency distribution of the compositions in zoned plagioclase crystals from granodiorite or as phenocrysts in andesite generally shows one or two maxima. The ground-mass plagioclases of andesites are reported to be variable in composition even within one lava flow; this variation is related to the mode of zoning in the co-existing plagioclase phenocrysts. The viscosity of the lava may be an important factor.

R. A. H.

SMITH (J. V.). *The effect of composition and structural state on the rhombic section and pericline twins of plagioclase feldspars.* Min. Mag., 1958, **31**, 914–928.

Stereograms are given of the calculated orientation of the rhombic section and of the (001) plane and on these are plotted poles of observed composition planes for twinning in plagioclases which are (a) probably in the low structural state, (b) in an intermediate or high structural state. Graphs of the variation of the calculated value of σ with chemical composition and structural state are also given and on these are plotted observed values of σ . In the more sodium-rich plagioclases determination of the orientation of the composition plane of pericline twins gives evidence of the structural state of the crystal at the time of formation of the twinning and this may differ from the structural state of the crystal at present. Since it is not possible to distinguish pericline and aclinic-A twins by X-ray methods the term *b*-axis twin is adopted to include both twin laws. In the composition range $\text{An}_0\text{--An}_{60}$ many of the specimens studied cannot be assigned unambiguously to either twin law as the observed composition planes do not differ from (001) by more than the possible experimental error; others may be unambiguously assigned to the pericline law.

W. S. M.

TOMISAKA (T.), SHIKUYA (G.), & NAKAMURA (H.). *Structural changes of schiller-feldspar due to the heat treatment: (II).* Journ. Min. Soc. Japan, 1957, **3**, 146–157.

Two specimens of oligoclase and two of labradorite, all showing schiller, had minute haematite crystals in planes parallel to (001), (010), (100), ($\bar{1}01$) and the pericline twin plane. On heating, these low-temperature plagioclases were converted to high-temperature forms, the haematite inclusions disappeared, and the schillerization faded.

R. A. H.

WASSERBURG (G. J.) & WOOD (J. A., Jr.). *The solubility of quartz at high temperatures and pressures.* Amer. Journ. Sci., 1958, **256**, 438.

Critique of J. A. Wood's theoretical discussion under the same title [M.A. 14-44], which is not so general as at first believed.

H. W.

BAILEY (S. W.), BELL (R. A.), & PENG (C. J.). *Plastic deformation of quartz in nature.* Bull. Geol. Soc. America, 1958, **69**, 1443-1446, 1 fig., 4 pls.

Fifty-five specimens from various geological occurrences have been examined optically, and quartz grains from them studied by Laue techniques. Deformation features included undulatory extinction, deformed and fractured lamellae, marginal granulation, decrease in frequency of Dauphiné twinning, and change of shape of the Laue spots. The optical features and the details of the X-ray patterns may be explained and correlated by a theory involving dislocation and polygonization whereby the bent crystal is transformed into a number of elongate, relatively perfect crystallites inclined to one another at small angles and separated by regions of atomic misfit. One of the three crystallographic a axes is always the major axis of bending, but no unique glide direction or plane has been established. The use of undulatory extinction to differentiate quartz grains as of igneous or metamorphic derivation is unjustified.

A. L. A.

SAHAMÄ (TH. G.). *A complex form of natural nepheline from Ivaara, Finland.* Amer. Min., 1958, **43**, 165-166.

A nepheline containing 19.8 atomic % K/(K+Na+Ca) is found to have cell dimensions a 17.4, c 76 Å corresponding to 27 times the cell volume of ordinary nepheline. A. P.

LEE (DONALD E.). *A chlorine-rich biotite from Lemhi County, Idaho.* Amer. Min., 1958, **43**, 107-111.

A biotite from Lemhi County, Idaho, has a chlorine content of 1.11% and a fluorine content of 0.23%. The biotite occurs in schist, associated with garnet, muscovite, and quartz with smaller amounts of iron-rich tourmaline and of zircon. A complete analysis is given for the biotite and the features of its association outlined. A. P.

COMPTON (ROBERT R.). *Significance of amphibole paragenesis in the Bidwell Bar region, California.* Amer. Min., 1958, **43**, 890-907, 1 fig.

New analyses together with sp. gr. and optical properties are reported for 5 amphiboles from closely associated metamorphic and intrusive rocks in the northwestern Sierra Nevada. Regionally extensive low-grade metabasaltic rocks containing abundant actinolite $[(\text{Na},\text{K})_{0.35}\text{Ca}_{1.9}(\text{Mg},\text{Fe}^{II})_{4.4}\text{Al}_{0.4}(\text{OH})_{1.6}\text{Si}_{7.7}\text{Al}_{0.3}\text{O}_{22}]$ are converted to hornblendic rocks in the contact aureole of a small batholith. Hornblende in the outer part of the aureole is associated with oligoclase,

epidote, and minor chlorite, and has the composition $(\text{Na},\text{K})_{0.35}\text{Ca}_{1.7}(\text{Mg},\text{Fe}^{II})_4\text{Fe}^{III},\text{Al}_{1.1}(\text{OH})_{1.9}\text{Si}_{6.7}\text{Al}_{1.3}\text{O}_{22}$, while hornblende in the inner part of the aureole is associated with andesine (and locally clinopyroxene), and has the composition $(\text{Na},\text{K})_{0.4}\text{Ca}_2(\text{Mg},\text{Fe}^{II})_{3.8}(\text{Al},\text{Fe}^{III})_{1.1}(\text{OH})_{1.7}\text{Si}_{7.7}\text{Al}_{1.3}\text{O}_{22}$. The abrupt conversion of actinolite to aluminous hornblende in the outer part of the aureole contrasts with gradational conversions in some regionally metamorphosed schists, and this contrast is probably caused largely by differences in the dehydration and reaction rates of the two environments. Ferrohastingsite $[(\text{Na},\text{K})_{0.8}\text{Ca}_2(\text{Fe}^{II},\text{Mg})_{3.8}(\text{Fe}^{III},\text{Al})_1(\text{OH},\text{Cl})_{2.1}\text{Si}_6\text{Al}_2\text{O}_{22}]$ formed in the inner part of aureole from rocks (metatuffs) low in Si and high in Igneous hornblende that crystallized with biotite in border zone of the batholith has the composition $(\text{Na},\text{K})_{0.8}\text{Ca}_{1.9}(\text{Mg},\text{Fe}^{II})_{4.4}(\text{Fe}^{III},\text{Al})_{0.8}(\text{OH})_{0.8}\text{Si}_{7.7}\text{Al}_{0.9}\text{O}_{22}$. A. P.

THOREAU (J.). *Le granite à riebeckite de la région du Kalembe (Kivu).* Bull. Acad. roy. Sci. Colon., Cl. Sci. n.s., Brussels, 1956, nouv. sér., **2**, 408-413.

Essential constituents are quartz, microperthite, albite, riebeckite, aegirine and magnetite; accessory zircon and lepidomelane. The riebeckite is pleochroic with α and blue, γ greenish-brown; low birefringence, mean refr. index 1.70, strong dispersion. Analysis gave: SiO_2 47.36, Al_2O_3 3.31, Fe_2O_3 18.61, FeO 15.74, MgO 2.21, CaO 0.92, Na_2O 7.67, K_2O 0.64, H_2O 0.48, TiO_2 2.35, F 0.27, = 99.45 (99.56 for F). Chemical analyses are given for two granite samples from different places and show the absence of Nb and Ta. The rock minerals also appeared spectrographically free from Nb and Ta.

R. V. T.

WILKINSON (J. F. G.). *The clinopyroxenes of a differentiated teschenite sill near Gunnedah, New South Wales.* Geol. Mag., 1957, **94**, 123-134, 3 figs.

Two clinopyroxenes have been chemically analysed from near the base and the top of the 500 ft thick Black Jack teschenite sill, and because they are zoned, a magnesium-rich fraction of the lower pyroxene, and an iron-rich fraction of the higher, have also been analysed. The range of composition is close to $\text{Ca}_{49}\text{Mg}_{37}\text{Fe}_{14}$ (base) to $\text{Ca}_{47}\text{Mg}_{33}\text{Fe}_{20}$. The average content of TiO_2 is close to 3% and of Al_2O_3 6%, and both decrease with fractionation. Many measurements of refractive indices and optic axial angles are used in an analysis of the types of zoning in these clinopyroxenes and their petrogenetic significance. Reversed zoning, interpreted as Mg-enrichment, characterizes 30-40% of the grains examined [M.A. 13-532, 14-146]. G. M. B.

KOUŘIMSKÝ (JIRÍ). *Contribution to the identification of magnesian pyroxenes.* Univ. Carolina, Geologica, 1956, no. 2, 125-148. (Russian and English summaries.)

For use along with optical constant and d.t.a. data for the identification of pyroxenes which have recrystallized in artificially fused rocks and which are often of submicroscopic or untypical development, a great number of roentgenograms of natural and synthetic pyroxenes has been prepared from a key to identification. In the present paper only the general data relating to pyroxenes of Mn^{II}, Mg^{II}, and II of the polyaugite group are included. The presence of II in pyroxenes is not ascertainable by means of powder photographs; only the extinction angle, which is greater than for other members of this isomorphous group, is suitable for this purpose. [M.A. 13-531] J. N.

HAMA (TH. G.) & HYTÖNEN (KAI). *Calcium-bearing magnesium-iron olivines*. Amer. Min., 1958, **43**, 862-871, 2 figs.

New chemical analyses are reported for a ferroan monticellite, a sub-calcium olivine, two calcian hyalosiderites and calcian ferrohortonolite. Optical properties and d_{130} spacings are reported for these and five other calcian olivines and the sp. gr. for several of them. The distinction between the forsterite-fayalite and the monticellite-kirchsteinitite (CaFeSiO_4) series cannot be made from refractive indices alone because of the overlap of the ranges of variation of indices in the two series, but the d_{130} spacing varies over discrete ranges in the two series, forsterite-fayalite 2.7659-8328 Å and monticellite-kirchsteinitite 2.934-2.956, allowing a sure distinction. Nevertheless, presence of some Ca in members of the first series and deficiency of Ca in members of the second series precludes accurate determination of composition in either series from d_{130} measurements alone. Indexed powder diffraction patterns are tabulated for a monticellite from Dewey mine, San Bernardino Co., California, and for synthetic kirchsteinitite. A. P.

ILSHIRE (H. G.). *Alteration of olivine and orthopyroxene in basic lavas and shallow intrusions*. Amer. Min., 1958, **43**, 120-147, 12 figs.

Alteration products of olivine and orthopyroxene, previously identified as iddingsite, bowlingite, and serpentine among other minerals, have been found to consist mostly of mixed layer smectite-chlorite with a variety of accessory minerals. Alteration products from shallow basic intrusions may contain antigorite or chrysotile as well as smectite-chlorite, and are much richer in MgO than those from basic lavas. Optically isotropic varieties (chlorophaneite) are closely associated with smectite-chlorite minerals and sometimes have a poorly developed chlorite(?) structure. It is probable that all of these secondary minerals can form by euteric alteration, but evidence is presented which suggests that oxidized varieties (commonly containing goethite) may also form by weathering of green varieties. Three partial

analyses of joint fillings in basaltic rock are given and a pair of analyses of the unaltered and the altered olivine basalt near Orange, New South Wales, illustrates the changes in bulk composition. It is concluded that equal volume replacement of Mg-rich olivine or orthopyroxene in basic lavas results in selective leaching of Mg which may be removed from the altered rock and recombined in the same secondary minerals in joints.

A. P.

WHITTAKER (E. J. W.) & ZUSSMAN (J.). *The characterization of serpentine minerals*. Amer. Min., 1958, **43**, 917-920.

Nagy and Faust [M.A. 13-462] and Kalousek and Muttart [M.A. 13-544] have recently dealt with serpentines as mixtures of chrysotile and antigorite. From the results of Whittaker and Zussman [M.M. 31, 107] it is apparent that at least one more variety, namely lizardite, must be taken into account among the components of serpentine.

A. P.

LAPHAM (DAVIS M.). *Structural and chemical variation in chromium chlorite*. Amer. Min., 1958, **43**, 921-956, 9 figs. 1 pl.

Six new analyses of chlorites with Cr₂O₃ content ranging from 0.10 to 6.47% are reported. Sp. gr. is given for these and for 2 other analyzed Cr-chlorites. Indexed X-ray powder diffraction patterns, optical properties and d.t.a. curves are given for 3 of the newly analyzed Cr-chlorites and for 6 others for which the Cr₂O₃ content has been estimated by X-ray spectrophotograph. Correlation of selected interplanar spacings and intensities of certain X-ray reflections with Cr content suggests that Cr may be substituted in positions with either tetrahedral or octahedral coordination in different chlorites. This is termed comorphism. It is proposed to restrict the name kochubeite to chlorites in which Cr is mainly in tetrahedral coordination and the name kämmererite to those in which it is mainly in octahedral coordination.

A. P.

SHIROZU (H.). *X-ray powder patterns and cell dimensions of some chlorites in Japan, with a note on their interference colors*. Min. Journ. [Japan], 1958, **2**, 209-223, 3 figs.

X-ray powder studies on 50 chlorites from Japan revealed two types of elementary cells, one with a 14 Å monoclinic and the other with a 14 Å ortho-hexagonal symmetry: the patterns of the former are closely similar but those of the latter vary in detail. The interference colours of the monoclinic types are frequently abnormal (usually so for Fe-chlorite) while the ortho-hexagonal types show normal interference colours. Analyses by the author are given for 11 fresh chlorites, including manganese leuchtenbergite A, type M, from a metamorphosed manganese ore deposit at Muramatsu, Nagasaki Prefecture; chlorite B, type M, from serpentinite at Sannō, Fukuoka Prefecture; chlorite C, type

M, forming a veinlet in manganese ore, Kumanohata mine, Shiga Prefecture; chlorite D, type H, associated with an iron-containing silica-stone deposit, Shōgasé, Kōchi Prefecture; and chlorite E, type H, from a quartz-Cu ore vein of the Kishu mine, Mié Prefecture. These data confirm that the basal spacing depends on the number of tetrahedral Al ions, and the *b* dimension on the number of (Fe+Mn) atoms in the structure. Curves are presented for the estimation of the composition of chlorite from X-ray powder data [M.M. 30-277].

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	H ₂ O+	Total	<i>d</i> ₀₀₁ (Å)	<i>b</i> (Å)
A	29.26	22.06	1.05	nil	0.69	34.08	13.11	100.33	14.18	9.21
B	29.71	19.75	0.29	6.59	0.80	30.79	12.55	100.12	14.21	9.23
C	29.73	17.95	0.68	10.05	8.24	21.84	11.90	100.81	14.24	9.28
D	24.56	16.07	5.10	34.66	1.42	6.16	11.93	100.74	14.21	9.34
E	23.38	19.32	2.51	38.38	0.58	5.39	10.62	100.66	14.15	9.35

Also: A, CaO nil, H₂O—0.08; B, CaO tr., H₂O—0.14; C, CaO nil, H₂O—0.42; D, CaO 0.30, H₂O—0.54; E, CaO tr., H₂O—0.48.

R. A. H.

FÚSTER (J. M.). *Origen y composición de las rocas de la serie de las charnockitas en la Guinea Española*. Est. Geológicos, 1957, **14**, 241–250.

The rocks of the charnockite series are very well represented in the Precambrian mountains of Spanish Guinea. They occur associated with rocks of similar mineralogical composition belonging to the amphibolite series. Within the same range of composition it is possible to find all transitions between the two series. Comparison of chemical composition of the basic members of both series shows that in the process of charnockitization there is no important variation in the chemical composition of the earlier rocks which might signify basification of rocks of the amphibolite facies during the transformation into granulites. (50 chem. anal.).

M. F.-A.

MIYAMOTO (N.). *Iron-rich saponite from Mazé, Niigata Prefecture, Japan*. Min. Journ. [Japan], 1957, **2**, 193–195, 2 figs.

Dark green saponite occurs covering the inner walls of amygdalites or as alteration products of glassy materials or plagioclase in altered basalt or tuff breccia. Chemical analysis gave SiO₂ 43.98, TiO₂ 0.16, Al₂O₃ 6.30, Fe₂O₃ 7.85, FeO 5.32, MnO 0.32, CaO 2.78, MgO 18.02, H₂O+ 9.24, H₂O—6.24, = '100.39'. X-ray powder data are tabulated, and the d.t.a. curve is figured; there is a sharp endothermic peak between 100° and 200°C. and a double endothermic peak at about 850° and 870°C.

R. A. H.

OLIVER (R. L.). *The origin of garnets in the Borrowdale Volcanic Series and associated rocks, English Lake District*. Geol. Mag., 1956, **93**, 121–139, 5 figs., 1 pl.

The various hypotheses of the origin of the almandine-rich garnets occurring in unmetamorphosed lavas, tuffs, and

intrusive rocks are reviewed, and new field, petrographical and chemical evidence is presented. Eight garnets were analysed for SiO₂, Al₂O₃, TiO₂, Fe₂O₃, FeO, MnO, MgO, and CaO, two for FeO, MnO, and MgO, and six for Cr, Sc, Y, and Ga. For the major elements, differences in composition are small, but show some correlation with composition of the host rock. The geological distribution of the garnets excludes a contact or regional metamorphic origin and much petrographical evidence is presented for the presence of the garnets in the 'Borrowdale' magma before eruption and intrusion. The conclusion is drawn that the garnets are pyrogenetic and they are considered to have crystallized at a temperature 'somewhat below 900°C'. S. R. T.

WINCHELL (HORACE). *The composition and physical properties of garnet*. Amer. Min., 1958, **43**, 595–600, 2 figs.

Refractive indices and lattice constants for ideal grossular, andradite, almandine, spessartite, and pyrope are plotted on rectangular charts. Superposed on these are projections of skew tetrahedra on which are drawn lines representing variation of specific gravity. [M.A. 13-536] A. P.

CLIFFORD (T. N.). *A note on kyanite in the Moine Series Southern Ross-shire, and a review of related rocks in the Northern Highlands of Scotland*. Geol. Mag., 1958, **95**, 333–346.

In the Moine schists of Southern Ross-shire kyanite and sillimanite were generated during para- and post-deformational stages of regional metamorphism respectively. Elsewhere in the Moine schists, kyanite is absent, chiefly owing to the unfavourable chemical composition of the schist and not because of the *PT* conditions of metamorphism. A new analysis of a pelitic Moine kyanite schist and two new analyses of almandine are given. Andalusite occurs in the Moine schists as a product of contact metamorphism, while sillimanite occurs in contact aureoles and also throughout the Moine schists as a product of amphibolite facies metamorphism.

R. St.J. L.

Petrography : petrofabrics

JONES (K. A.). *The significance of Schnitteffekt in petrofabric diagrams*. Amer. Journ. Sci., 1959, **257**, 55–62.

Tabular or columnar grain-shapes may cause petrofabric diagrams made from thin sections to show false evidence of preferred orientations. This can be recognized if the sections are cut at 45° to the true *b*-axis, or 90° to the *c*-axis of the fabric. Another control can be had by measuring two or more non-parallel sections, or, according to the author, by measuring two or more classes of grains of the mineral, for example (a) large and (b) small grains; or grains that are (a) included in, and (b) external to, some other mineral in the rock.

H. W.

KAZITZIN (YU. V.) & ALEXANDROV (G. V.)] Казицын (Ю. В.) и Александров (Г. В.). Построение мотивов плоских сеток кристаллических структур на плоскости произвольного задания. [*The construction of patterns of flat nets of crystalline structures and the projection of structures on given planes.*] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1956, **85**, 187–201, 8 figs. S. I. T.

SHAFRANOVSKY (I. I.)] Шафрановский (И. И.). Группы симметрии в структурной петрологии. [*Groups of symmetry in structural petrology.*] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1956, **85**, 491–497, 6 figs.

The notion of symmetry is extended to structurally determined orientation of grain aggregates in rocks. S. I. T.

[VISTELIUS (A. B.)] Вистелиус (А. Б.). К статистике микроструктурных диаграмм. [*On the statistics of microstructural diagrams.*] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1957, **86**, 691–703, 6 figs.

It is suggested that structural diagrams should be based on the azimuthal, equal-distance projection, such as that proposed by V. V. Kavraisky in 1953. Mathematical methods involved in this work are critically examined and certain suggestions made.

S. I. T.

PETRUK (WILLIAMS). *Petrofabric analyses of the Amisk and Missi sediments in the Amisk and Hanson Lakes areas :* [M.Sc. Thesis, Univ. Saskatchewan, 1955, 46 pp., 1 map, 9 figs., 5 pls.], Abstr. Canad. Mining Journ., 1956, **77**, no. 3, 70.

Single quartz girdles about the 'b' axis indicate one period of folding. Biotite flakes were rotated into S-surfaces by translation gliding, into intersecting shear planes and by recrystallization along the AB plane of the strain ellipsoid. Recrystallization was the main factor in the development of foliation.

W. R. G.

CHRISTIE (JOHN M.). *Dynamic interpretation of the fabric of a dolomite from the Moine thrust-zone in north-west Scotland.* Amer. Journ. Sci., 1958, **256**, 159–170.

The fabric of a dolomite with mylonitic texture is analysed, and compression and tension axes inferred from {0221} twin lamellae are found to be parallel to those inferred from internally rotated lamellae of the L₉ type. The amount of strain is calculated from the amount of rotation of L₉ lamellae.

R. E. W.

CRAMPTON (C. B.). *Structural petrology of Cambro-Ordovician limestones of the North-West Highlands of Scotland.* Amer. Journ. Sci., 1958, **256**, 145–158.

Analysis of preferred orientation of compression axes constructed for twinned {0221}-lamellae of dolomite in the lime-

stones is made and a tentative kinematic interpretation relates fabric symmetry to the generally accepted direction of thrust movements.

R. E. W.

WEISS (L. E.). *A study of tectonic style : structural investigation of a marble-quartzite complex in southern California.* Univ. Calif. Publ. Geol. Sci., 1954, **30**, no. 1, 1–102.

The structures of a marble-quartzite complex forming part of the Orogrande series of Carboniferous age have been mapped in detail over a rectangular area covering about one-sixth of a square mile about two miles west of Barstow, San Bernardino County, California. The textures of the rocks have been analyzed after the manner of the Sander school.

A. P.

MACKIE (J. B.). *Petrofabric analyses of two quartz-mica-piedmontite schists from north-west Otago.* Trans. Roy. Soc. New Zealand, 1947, **76**, 362–368, 13 figs.

Fabric diagrams are given for optic axes of quartz and (001) poles of muscovite. Deformation lamellae of quartz define two statistical S-planes at angles of 58° and 66° to the megascopic schistosity. A histogram shows that in the majority of grains the angle between the poles of the lamellae and [0001] is 10–30° with a secondary maximum at 80–90°.

D. S. C.

SCHROCKE (H.). *Zur Regelung von Andalusit in Kristallen Schiefern.* Neues Jahrb. Min., Monatshefte, 1954, 177–180, 4 figs.

A study of the orientation of andalusite in schists shows a strong tendency to parallelism of the c axes. R. A. H.

Petrography, regional

BAILEY (E. B.). *Some chemical aspects of South-West Highland Devonian igneous rocks.* Bull. Geol. Survey Gt. Britain, 1958, **15**, 1–20, 3 figs.

Review of distribution of major chemical elements in rocks of Devonian age from the South-West Highlands and of Carboniferous and Tertiary age throughout Scotland. 86 Devonian and 12 other analysis are cited, and one new analysis of Ballachulish Granite is given. The Devonian parent magma was relatively wet, giving a hornblendic facies, the Tertiary parent magma was relatively dry.

P. A. S.

PHILLIPS (W. J.). *The Criffell-Dalbeattie granodiorite complex.* Quart. Journ. Geol. Soc. London, 1956, **112**, 221–239, 1 fig., 1 map.

Re-mapping of the complex has been undertaken with particular reference to the structure and mode of emplacement of the oval-shaped 'main granodiorite', forming the

outcrop north-east of the Urr Water. Marked planar orientation of xenoliths ('flow foliation') at the margins is attributed to magmatic flow and is distinguished from the secondary foliation which was developed through upward movement after partial consolidation. The various components of the complex are related through postulating the metasomatic transformation of hornfelses to form quartz-diorite, circulation of this mobilized material on a small scale to form intermediate granodiorite, and longer and more active circulation of the material to form the more basic main granodiorite.

G. M. B.

RAO (M. SRIRAMA). *Composite and multiple intrusions of Lamlash-Whiting Bay region, Arran.* Geol. Mag., 1958, **95**, 265-280.

A description of certain composite and multiple intrusions in south-east Arran, with two new chemical analyses. The occurrence of closely related basic, acid, and intermediate rock types is attributed to the intimate association of basic and acid magmas at depth, with resultant hybridization.

W. J. W.

MITCHELL (G. H.). *The geological history of the Lake District [England]. (Presidential Address).* Proc. Yorks Geol. Soc., 1956, **30**, pt. 4, 408-463, 5 figs.

A summary of present-day knowledge of the area, which includes the age relationships of the major intrusions and a broad description and detailed correlation of the subdivisions of the Borrowdale Volcanic Series.

G. M. B.

HENSON (F. A.). *The geology of south-west Jersey, Channel Islands.* Proc. Geol. Assoc., 1956, **67**, 266-295.

A detailed description, accompanied by new chemical analyses, of the four principal types of granite composing an intrusive complex (probably of Armorican age) in south-west Jersey.

W. J. W.

EMELEUS (C. H.). *The granites of the Western Mourne Mountains, County Down.* Sci. Proc. Roy. Dublin Soc., 1955, **27**, 35-50, 2 figs., 2 pls.

Two intrusions G4 and G5 of contrasting appearance are mapped across N.E. faults and their emplacement ascribed to cauldron subsidence on ring dyke fractures subsequent to those of the eastern Mourne. Detailed petrographic descriptions and two new chemical analyses are given. Both granites show dome-shaped contacts; limited stoping occurs in the country rock and the contact between G4 and G5, which normally is sharp, in places indicates a mechanical disintegration of G4. The associated cone sheets are pre-granite in age.

J. P.

WALKER (G. P. L.) & LEEDAL (G. P.). *The Barnesmore Granite complex, County Donegal.* Sci. Proc. Roy. Dublin Soc., 1954, **26**, 207-243, 10 figs., 1 pl.

A Caledonian age is given to the dome-shaped granite complex emplaced in undisturbed Dalradian schists. The show growth of sillimanite and andalusite and the introduction of microcline at the contacts. Subsidence along a ring dyke type fracture made place for the main granite G2; earlier granodiorite G1 is only partially preserved. Further sinking along a fracture in G2 with collapse of the unsupported walls has produced a sheet complex, intruded into arc-shaped fractures, of the finer-grained granite G3. Deuteric alteration has removed quartz from patches of the granite leaving syenitic and muscovite-rich rocks. Caledonian and Tertiary dyke swarms are described and unusual veins associated with the former indicate the violence of the intrusion and offer evidence of a schist floor to the complex. Detailed petrographic descriptions are given for all rock types.

J. P.

WHITTEN (E. H. T.). *The Gola Granite (Co. Donegal) and its regional setting.* Proc. Roy. Irish Acad., 1957, **58**, 245-292, 16 figs., 1 pl.

A northward extension of the dioritic migmatites of Thorloughill illustrates the evolution of a quartzose potassic granite (Gola) by a process of recrystallization and metasomatism. Its boundaries are defined by isopleth maps of modal quartz colour index, feldspar ratio, and total feldspar content; statistical analysis tests and approves the use of these maps. Replacement textures are described in detail. Microcline replaces biotite and oligoclase, albite rims develop between the two feldspars and are attributed to a marginal modification of the plagioclase by late stage circulation along the boundary. Quartz later replaces both feldspars and may show almost 'single' crystal orientation over large areas—a stage in the growth of quartz porphyroblasts. A planar fluxion structure in the older rock, defined by autoxoliths, is thought to be exploited by the metasomatic processes giving good planar and linear structure for the microcline porphyroblasts. This chemical culmination in the Gola granite is considered an intermediate stage in the granite series between the 'older' (Thor) and 'newer' (Rosses) types.

J. P.

PATTERSON (E. M.) & SWAINE (D. J.). *The Tertiary dolerite plugs of north-east Ireland—A survey of their geology and geochemistry.* Trans. Roy. Soc. Edin., 1957, **63**, 317-331, 1 map.

In a review of the field relations, distribution, and petrography of twenty-nine dolerite plugs associated with the Tertiary lava plateau of north-east Ireland it is noted that all but two of the plugs are composed of olivine-dolerite, the exceptions being a pyroxene-rich dolerite and a tholeiitic type with abundant chlorophaneite. The trace element contents of thirteen of the plugs are listed and new chemica-

analyses are given for an olivine-basalt plug at Carrickarade and a dolerite plug at Carnmoney. The petrogenetic relationships between the olivine-dolerites and the average Tertiary olivine-basalt lava of the area are briefly considered. [M.M. 22-439; M.A. 11-35, 12-378]

R. A. H.

LEAKE (BERNARD ELGEY). *The Cashel-Lough Wheelaun intrusion, Co. Galway*. Proc. Roy. Irish Acad., 1958, 59, B, 155-203, 13 figs., 1 pl.

A synorogenic ultrabasic and basic intrusion hornfelsed its regionally metamorphosed country rocks of sillimanite- and almandine-bearing pelitic Connemara schists; continuing regional metamorphism, folding, and subsequent migmatization later altered the intrusion itself. The igneous rocks originally varied from olivine-two pyroxene rocks, to olivine-free gabbros and norites; but metamorphism induced widespread amphibolization, and hornblende, or occasionally anthophyllite and cummingtonite, is now a major constituent of all the rocks. Optically determined compositions of olivines (Fo_{87} to Fo_{80}), plagioclases (An_{86} and An_{65} to An_{55}), and orthopyroxenes (En_{84} to En_{87}) are given, together with chemical analyses, modes, and norms for ten rocks: analysis by R. A. Howie of a hypersthene from a bytownite-orthopyroxene-hornblende-biotite rock, southwest of Lough Fadda, gave SiO_2 51.76, Al_2O_3 2.82, TiO_2 0.17, Fe_2O_3 1.46, FeO 18.30, MnO 0.35, MgO 23.21, CaO 1.75, Na_2O 0.03, K_2O 0.00, H_2O - 0.03, = 99.88: $2V_a$ 62 $^{\circ}$. Cryptic variation occurs in the Fe/Mg ratio of orthopyroxenes and hornblendes, in that this ratio increases for these minerals in passing from the olivine-bearing rocks to the pyroxene-rich types, to the hornblendites; the olivine-bearing basic rocks thus have more magnesian hornblendes and orthopyroxenes than the bytownite-hornblende-pyroxene rocks. It is suggested that the various ultrabasic intrusions of Connemara were formed during a single injection period [M.A. 14-154]

R. A. H.

OFTEDAHL (CHRISTOFFER). *Studies on the igneous rock complex of the Oslo region : XVI. On ignimbrite and related rocks*. Skrift. Norske Vidensk.-Akad. Oslo, I. Mat.-Nat. Kl., 1957, no. 4, 21 pp., 4 figs.

A group of agglomerate-looking breccias, transitional into very fine-grained igneous rocks, which were earlier considered to be intrusive are here shown to have all the characteristics of ignimbrites or welded tuffs. These welded tuffs occupy a fairly well-defined stratigraphical position in the lava sequence; the associated felsitic rocks are considered as intrusive plugs connected with the explosions. Some comments are presented on the magmatic problems involved. [M.A. 12-545, 13-524, 526]

R. A. H.

DHELLEMES (ROBERT). *Étude géologique du massif cristallin des Aiguilles Rouges (Alpes de Savoie)*. Trav. Lab. Geol. Fac. Sci. Univ. Grenoble, 1956 (for 1954-55), 32, 67-94.

A study of the crystalline basement and of the sedimentary rocks related to it. The crystalline series comprises gneisses and migmatites of Le Brévent, chloritized biotite-gneisses, slightly cataclastic, of Lake Blanc, mylonitized gneisses of Pormenaz. Among the granites are distinguished that of Pormenaz, a pre-Carboniferous, syntectonic intrusion with microcline, chlorite and amphibole, sometimes mylonitized; that of Vallorcine, post-tectonic, porphyritic, with biotite and muscovite. The sedimentary formations represented are Coal Measures, Permian, Trias, and Lias slightly metamorphosed.

E. J. & A. S.

LAPADU-HARGUES (P.). & MAISONNEUVE (J.). *Les relations probables en Corse, entre le massif granitique et les pré-tendus 'schistes lustrés'*. C.R. Acad. Sci. Paris, 1956, 243, 2107-2108.

It is now admitted that a complex composed of metamorphic rocks and basic intrusions overlaps on the granitic massifs of the north-east part of the island. The authors have found, between Corte and Vivario, magmatic contacts between the granite and the schists. E. J. & A. S.

MONTENEGRO DE ANDRADE (M.). *Rochas Graníticas de Angola*. Junta de Investigações do Ultramar [Portugal], Mem. Sér. Geol., 1954, 4, 464 pp., 199 figs.

This memoir represents a compilation of all available data on the acidic rocks of Angola, but a considerable proportion of it represents new results and observations by the author. The coarse-grained rocks studied include alkaline granites with aegirine and riebeckite, or with abundant fluorite, and numerous calc-alkaline granites, together with granodiorites, quartz diorites and various acid and intermediate members of the charnockite series. Granite porphyries, rhyolites, and dacites are also described and the results of many new chemical and modal analyses are presented.

R. A. H.

CHOUBERT (GEORGES), FAURE-MURET (ANNE), & JÉRÉMINE (ÉLIZABETH). *Sur les massifs éruptifs du Jebel Tarfafa (Haut Atlas oriental), leurs contacts et leurs enclaves*. C.R. Acad. Sci. Paris, 1956, 243, 394-397.

Petrographical description of 3 eruptive masses of Tarfafa, each composed of a syenite centre and a monzonite-dioritic border. These masses are in contact with phyllites (Palaeozoic or pre-Cambrian) and, locally, with Triassic marls and Liassic limestones. The phyllites are transformed at the contact to crystalline mica-schists often with andalusite and corundum, the marls to aggregates of quartz, albite,

and chlorite, the limestones to marbles both pure and carrying pyroxene, amphibole and epidote. Enclaves of country rock within the intrusions have undergone metamorphic transformation. Anal. : A, syenite ; B, monzonite, C, diorite.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MgO	CaO	Na ₂ O	K ₂ O	H ₂ O+	Total
A	66.25	17.50	3.05	1.00	0.15	0.90	4.70	5.50	0.60	100.67
B	49.80	16.50	3.50	7.00	4.10	6.40	3.30	2.50	1.50	100.44
C	50.90	16.70	3.80	7.20	5.65	7.00	2.25	2.10	2.10	100.62

Totals include TiO₂ 0.40, 5.00, 2.15 ; P₂O₅ 0.04, 0.38, 0.28 ; MnO 0.03, 0.28, 0.21 ; H₂O — 0.55, 0.18, 0.28 for A, B, and C respectively.

A. S.

CHOUBERT (G.), FAURE-MURET (ANNE), & JÉRÉMINE (ÉLIZABETH). *Roches éruptives et métamorphiques de la région du Jebel Tarfafa et du Jebel Mesrouh (Haut Atlas oriental)*. Notes Serv. géol. Maroc, 1958, **16**, no. 143, 205–231, 9 pls., 1 map.

Quartz-syenite with micropegmatite is bordered by monzonite and diorite with ophitic structure. Locally the border-rock is a breccoid mass of enclaves of palaeozoic sediment in a diorite cement. Epidotites and an odinite are described ; epidote is regarded in part as primary. Thermal metamorphism produces andalusite-corundum hornfels from Palaeozoic shales, spotted rocks rich in epidote and chlorite from Triassic shales, and calcsilicate rocks from Liassic limestone. A white aplitic rock very poor in potash and rich in soda, composed of quartz, plagioclase, and chlorite with a chemical composition unknown among igneous rocks occurs in the altered Trias and is termed a pneumatolytite. Lit-par-lit invasion of syenite in Palaeozoic shales produces rocks of migmatitic aspect. 17 chemical analyses are given : 3 syenites, 2 monzonites, 7 diorites, 1 odinite, 1 Triassic basalt, 3 pneumatolytites. J. Ph.

PERRIN (RENÉ) & ROUBAULT (MARCEL). *Observations nouvelles sur les serpentines des Alpes Françaises et d'Algérie*. Sciences de la Terre, 1955, no. hors série, 151–165.

On the formation of massive serpentine from limestones, more or less argillaceous and siliceous, in the French Alps (Queyras, Hautes Alpes, and the region of Briançon) and in Algeria. General remarks on the problem of the peridotites. 11 chemical analyses. E. J. & A. S.

DELHAL (J.). *Les massifs crystallins de la Lulua et de Lueta (Kasai)*. Mem. Inst. géol. Univ. Louvain, 1957, **20**, 66 pp., 2 pls., 1 map.

The massifs described lie between the 7th and 8th parallels of south latitude and between the frontier of Angola (R. Kasai) and the 23rd meridian E. The Lulua massif, more particularly studied, comprises a great complex of crystalline, basic and acid rocks referred to the charnockitic series. Compared with analogous complexes, specially those

those of Madras and of Uganda, the Kasai rocks have certain special characteristics ; in the basic members plagioclase has a higher An content, and in the acid members (charnockites *sensu stricto*) a low proportion of K-feldspar associated with the plagioclase. The latter character shown in chemical analysis by the marked dominance of soda over potash and relates the Kasai charnockites to enderbite. The various facts would accord with the genetic sequence : emplacement of magmatic noritic gabbro into the old granitic basement, subsequent metamorphism, then a stage of deformation apparently connected with a pulse of granitization, lastly retrogressive metamorphism. This study includes about 30 chem. anal., various tables of mineralogical data, 2 plates of photomicrographs, and a map on which all the places of observation are indicated [M.A. 13–351, 14–154]

J. Th.

VARLAMOFF (N.). *Transitions entre les aplites et les pegmatites dans les zones de contact des massifs granitiques de concessions de Syméatin à Kalima (Maniema, Congo belge)*. Ann. (Bull.) Soc. géol. Belgique, 1953–54, **77**, B101–115, 1 fig.

Description of veins which constitute types intermediate between aplites and pegmatites. The author concludes that a residual magma injected into fissures might, according to circumstances, produce aplite, pegmatite, or rocks of intermediate texture. To each type of aplite would correspond a definite type of pegmatite and we may imagine there is not 'one aplite' but a series of rocks with aplitic texture which crystallize between the epimagmatic stage of A. E. Fersman and the phase E of his pneumatolytic stage corresponding to beryl-bearing pegmatites.

J. M.

VARLAMOFF (N.). *Tendances actuelles dans l'étude des pegmatites à travers le monde : revue des travaux sur les pegmatites du Congo belge et du Ruanda-Urundi ; proposition d'une classification des pegmatites du Congo belge et du Ruanda-Urundi*. Ann. (Bull.) Soc. géol. Belgique, 1953–54, **77**, B245–267, 2 figs.

The proposed classification takes account of the fact that with increasing distance from the magmatic hearth one meets successively pegmatites with biotite, pegmatites with 2 micas, and pegmatites with muscovite only. These three categories are next subdivided according to the appearance of characteristic minerals, such as tourmaline, cassiterite, columbo-tantalite, beryl, amblygonite, spodumene, albite, cleavelandite, etc. [See following abstract]

J. M.

SAFIANNIKOFF (A.). *Classification des pegmatites du Congo belge et du Ruanda-Urundi*. Ann. Soc. géol. Belgique, 1954–55, **78**, fasc. spéc., 57–69, 1 fig.

Criticism of the classification of pegmatites proposed by

Varlamoff [preceding abstract]. Erection of a classification of pegmatites based on the presence of certain minerals (even normally present) constitutes a petrographical error. Pegmatites of pure descent are the exceptions. Distribution of pegmatites round a granitic mass is complex. The author gives examples of pegmatites which have been studied in detail to illustrate his thesis.

J. M.

TEENSTRA (B.). Contribution à l'étude des pegmatites de la partie nord-est de la province orientale du Congo belge. Ann. Soc. géol. Belgique, 1954-55, **78**, fasc. spéc., 51-55.

Brief description of pegmatites, aplites, veins of granite, and veins of quartz.

J. M.

VARLAMOFF (N.). Matériaux pour l'étude des pegmatites du Congo belge et du Ruanda-Urundi. I. Répartition des types de pegmatites autour de la partie nord-ouest du grand massif granitique de Nyanza (Ruanda, Afrique). Ann. Soc. géol. Belgique, 1954-55, **78**, fasc. spéc., 1-23, 1 fig., 1 map.

Ditto II. Transitions entre les pegmatites et les filons de quartz dans les massifs granitiques des régions stannifères de Maniema (Congo belge). Ibid., (Bull.), 1955-56, **79**, B385-397, 4 figs.

In the first paper the author defines the term ' pegmatite type ' created by A. E. Fersman, then gives itineraries for examination of various types of pegmatite which are described. In the second paper he describes transitional rocks, namely veins composed of quartz and decreasing amounts of microcline, which are injected into fissures in the granites.

J. M.

WOODLI (R.). Découverte d'une roche à olivine dans la région de Kilo (NE du Congo belge). Ann. (Bull.) Soc. géol. Belgique, 1954-55, **78**, B135-137.

Description of a basalt the mineral composition of which is approximately : augite, 30-40% ; olivine, 10-20% ; feldspar, 50-60% ; accessory minerals 0-5%. J. M.

DENAHEYER (MARCEL E.). Révision de la famille des niligongites. C.R. Acad. Sci. Paris, 1956, **243**, 80-82.

The type of the niligongites is the granular form which is found as blocks scattered on the edges of the crater of Nyiragongo (formerly Niligongo), an active volcano of the Virunga range, Kivu (Belgian Congo). The niligongites are classed between the missourites and the ijolites. They are feldspathoidal rocks without feldspar, containing nepheline, leucite, often melilite, abundant augite, scarce olivine, accessory melanite, perovskite. The structure may be granular, microgranular, doleritic, and even microlitic. According to

Lacroix (1933) the granular rocks arkite, turjaite, and algarvite are heteromorphic forms of the niligongites ; the microlitic forms are leucite-nephelinite, and sodipotassic ankaratrite (sometimes limburgitic). Nine chem. anal. are given, including two new as follows : SiO_2 41.92 (40.38), Al_2O_3 18.43 (4.84), Fe_2O_3 4.83 (8.93), FeO 5.67 (6.71), MgO 2.81 (10.89), CaO 10.28 (17.99), Na_2O 5.58 (1.69), K_2O 5.66 (1.54), $\text{H}_2\text{O} + 1.27$ (2.68), $\text{H}_2\text{O} - 0.27$ (-), TiO_2 2.64 (3.30), P_2O_5 0.56 (0.75), MnO 0.21 (0.36), $= 100.13$ (100.06), of an ejected block of niligongite from the cone of Nyiragongo, anal. F. Raoult, and (in brackets) of a sodipotassic melilite ankaratrite, from Nord de Koitobbos, Mt. Elgon, Kenya, anal. Sahlbom.

E. J. & A. S.

SABET (A. H.). Geology of some dolerite flows on the Red Sea coast, south of El Qoseir. Egypt. Journ. Geol., 1958, **2**, 45-58, 2 pls., 2 figs. Summary in Arabic, ibid., 59-60.

The mode of occurrence and petrography of some lava flows of porphyritic olivine dolerite south of El Qoseir are given by the author. Comparison with similar Oligocene flows in other parts of Egypt is drawn. E. M. El S.

[DMITRIEV (S. D.)] Дмитриев (С. Д.). Структуры гранитных пегматитов Прибалхашья и некоторые особенности их формирования. [Structures of granite pegmatites from the Balkhash region and certain features of their formation.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, ser. 2, **87**, 208-212, 12 figs.

The following structures of granite pegmatites are described and discussed : the structure of leaching and recrystallization, graphic, porphyroblastic or metacrystalline, apographic and block structures.

S. I. T.

[MILASHEV (V. A.)] Милашев (В. А.). Кимберлиты южной части Среднеоленекского района. [Kimberlites of the south part of the Middle Olenek region.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 315-326, 5 figs.

Kimberlite pipes from the region of the Olenek River, northern Siberia, are described. They are highly carbonatized eruptive breccias composed of serpentized feric minerals, ores, phlogopite, chlorite, garnets, and other minerals. Some of these minerals are described, and chemical analyses of minerals and kimberlites are given.

S. I. T.

[VOLOTOVSKAYA (N. A.)] Волотовская (Н. А.). Магматический комплекс ультраосновных, щелочных и карбонатных пород массива Вуори-Ярви. [The magmatic complex of ultrabasic, alkaline and carbonate rocks of Vuori-Yarvi massif.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 290-303, 5 figs.

The Caledonian magmatic complex of Vuori-Yarvi [Kola peninsula] intruded into pre-Cambrian metamorphic rocks, in plan appears as a rough ellipse 6×3 km. Four intrusive phases are distinguished: (1) ultrabasic, represented by pyroxenites, mica-pyroxenites, peridotites, and olivinites; (2) alkaline, represented by ijolites, ijolite-melteigites, melteigite, and rare jacupirangites and malignites; (3) magnetite ores containing calcite, apatite, and forsterite; (4) carbonatites. The central part of the intrusion is made mainly of pyroxenite which, along the periphery, is cut by a conic complex of alkaline rocks, and the whole cut by hydrothermal veins and lenses of ores and carbonatites. The massif is surrounded by a wide exocontact zone of fenitized gneiss and other rocks. Ten chemical analyses of rocks are given. A comparison with other ultrabasic-alkaline-carbonatite intrusions of Caledonian age found in this region is made. S. I. T.

[КУХАРЕНКО (А. А.)] Кухаренко (А. А.). Палеозойский комплекс ультраосновных и щелочных пород Кольского полуострова и связанные с ним редкокоментальные месторождения. [The Palaeozoic complex of ultrabasic and alkaline rocks of Kola peninsula and the rare metal deposits connected with it.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 304–314, 1 fig.

Twelve previously described ultrabasic-alkaline complexes of Kola peninsula are discussed. They are of Middle Palaeozoic age (305–375 m.y.) and are made of olivinite, pyroxenite, melteigite, ijolite, urtite, carbonatite, and various ores. The ores and minerals are discussed and a genetic classification of rocks and minerals is proposed. The most striking geochemical feature of these rocks is the association of typical elements of the ultrabasic-basic association such as Mg, Fe, Ti, V, with elements of intermediate-acid alkaline association such as the rare-earths, Nb, Ta, Y, Be, Zr, Hf, Th, U, present in such minerals as knopite, pyrochlore, tantalum-niobates and others. S. I. T.

KUNO (H.), YAMASAKI (K.), IIDA (C.), & NAGASHIMA (K.). Differentiation of Hawaiian magmas. Japanese Journ. Geol. Geogr., 1957, **28**, 179–218, 14 figs.

Small veins of dolerite pegmatite with patches of granophyre in the middle are recorded as offshoots from an intrusive mass of quartz dolerite in Honolulu, and a segregation vein of iron-rich basalt is reported from a flow of tholeiitic olivine basalt exposed on the caldera wall of Kilauea. These veins are believed to represent products of fractionation of tholeiite magma after its emplacement, and the presence of granophyre is taken to indicate the possibility of generation of granitic magma from tholeiite magma simply through fractional crystallization. The tholeiite magma, it is suggested, has been generated by partial melting of the upper portion of the peridotite sub-

stratum, while the alkali olivine basalt magma is formed by partial melting of the lower portion of the substratum. Nine new rock analyses are given, and the optical properties of pyroxenes in the quartz dolerite and its differentiates are tabulated.

R. A. H.

SUKHESWALA (RATAN) & POLDERRAART (ARIE). Decan basalts of the Bombay area, India. Bull. Geol. Soc. America, 1958, **69**, 1475–1494, 4 figs., 1 pl.

Basalts and associated rocks exposed in the Bombay area belong to the Upper Deccan group, probably of Tertiary age. The associated rocks include tuffaceous sediments which were, in part, deposited in fresh water, and relatively small extrusions and intrusions of highly mafic rocks (monzonite, ankaramite, oceanite) and of rhyodacites and rhyolites. Petrographical descriptions of the prevailing rock types are given with 9 new chemical analyses. 64 analyses of Deccan rocks are tabulated, averages calculated for the Deccan basalts and for the Upper and Lower groups; the analyses are plotted on 4 types of diagram. Like many basaltic provinces the Deccan province shows an initial stage of iron enrichment followed by dominant alkali enrichment. The average Deccan basalt has somewhat more FeO and less Al₂O₃ and MgO than most tholeiitic basalts. The province is marked by the scarcity or absence of pigeonite in Deccan basalt, the small variation in composition in most of the basaltic rocks, the absence of lavas of intermediate composition, and the very small proportion of felsic lavas relative to the basalts.

A. L. A.

SUBRAMANIAM (A. P.). Petrology of the anorthosite-gabbro mass at Kadavur, Madras, India. Geol. Mag., 1956, **93**, 287–300, 1 fig., 1 pl.

A small, funnel-shaped pluton occupying 20 square miles and intruded into Archaean schists is briefly described. It consists of a narrow (chilled?) margin of fine-grained gabbro, a border facies of foliated gabbros and anorthosites, and a thick core of anorthosite. Four new chemical analyses of rock-types other than the marginal gabbro, indicate the chemical uniformity of the mass. A few optical properties of plagioclases, pyroxenes, and of a hornblende are provided. The plagioclase has an almost uniform composition of An_{50–55}, and the crystals, up to 4 inches long, often have granulated margins. The intrusion is believed to have affinities not with the Bushveld-Stillwater type of layered intrusion, but with the Adirondack-Quebec type of predominantly anorthositic intrusion, scarcely layered, and derived from a primary gabbroic-anorthositic magma.

G. M. B.

WILKINSON (J. F. G.). The petrology of a differentiated teschenite sill near Gunnedah, New South Wales. Amer. Journ. Sci., 1958, **256**, 1–39, 6 figs., 2 pls.

Fractional crystallization without significant gravitational movement of crystals can explain the variations in the eschenites of the Black Jack sill, 1 mile in diameter and 600 feet thick, which grades upward from porphyritic basaltic), through ophitic (doleritic), to non-ophitic (gabroic) teschenite. Mineral identities and compositions were derived from measurements of physical properties of olivine Fa_{21} to Fa_{60}), plagioclase (An_{70} to An_{55}), clinopyroxene $\text{Ca}_{48}\text{Mg}_{32}\text{Fe}_{15}$ to $\text{Ca}_{37}\text{Mg}_{34}\text{Fe}_{19}$), zeolite (thomsonite and natrolite), analcime, titanomagnetite, apatite, chlorite, carbonates, and alkali feldspar (Or_{26}). The widespread and abundant microcrystalline mesostasis has approximately the composition of analcime syenite. Ten new chemical analyses and norms of 10 rocks confirm the data in the petrographic and micrometric descriptions of about 60 specimens representing all parts of the sill and a few associated rocks. [M.A. 13-532, 14-156; M.M. 31-443]

H. W.

GRADWELL (R.). Post-tectonic granite-gabbro complexes in South-eastern Queensland. *Geol. Mag.*, 1958, **95**, 347-350.

Intrusion of gabbro was followed by progressive recrystallization and replacement of country rock to form trondhjemites, granodiorites, and, with increased mobilization, intrusive granites. W. J. W.

ROUTHIER (P.). Position et signification des certains grands massifs péricléditiques de Nouvelle-Calédonie. Proc. 7th Pacific Science Congress (Auckland & Christchurch meeting), 1953 (for 1949), **2**, 62-71, 3 figs.

Several peridotite [and serpentinite] masses on the west coast of New Caledonia are shown not to be intrusive plugs, but rather to be in the form of huge lenses or cakes, with plane or feebly warped surfaces, resting upon Eocene volcanic flows. It is suggested that these peridotites and serpentinites have arisen during great fissure eruptions of Eocene age, and thus form part of an extrusive assemblage. This hypothesis does not apply to all the ultramafic bodies of the island. Certain practical bearings of this hypothesis on the interpretation of economic deposits associated with the ultramafic bodies are briefly discussed. W. A. W.

AVIAS (JACQUES). Relations minéralogiques et géochimiques entre les serpentines et périclédites de Nouvelle-Calédonie, leurs inclusions, leurs enclaves, les roches encaissantes. *Sciences de la Terre*, 1955, no. hors série, 213-235.

The peridotite and serpentine masses of New Caledonia exhibit mineralogical and geochemical characters complementary to those of the associated rocks—inclusions, enclaves, more or less metamorphosed rocks surrounding them. This

'complementarité' could be explained by metasomatic segregation of the ferromagnesian ions (Mg, Ni, Co, etc.) and the expulsion of the 'complementary' ions (Na, K, Ca, etc.). A correlation between parageneses and geographical distribution of the rocks on the one hand and certain agents of ionic diffusion on the other is advanced. Volumetric calculations show that the association of the ultrabasites with former submarine flows can arise through the production of ultrabasites by exchange of material, by ionic diffusion to the interior of flows originally basalt-oceanites. The remainder, impoverished in magnesia and enriched in Ca and Na, would have yielded the dolerites, spilites and chlorite-rocks actually associated with the ultrabasites. Seven chemical analyses.

E. J. & A. S.

MATHEWS (W. H.). Petrology of Quaternary volcanics of the Mount Garibaldi map-area, southwestern British Columbia. *Amer. Journ. Sci.*, 1957, **255**, 400-415, 9 figs.

The mineralogy of a British Columbian suite of volcanic rocks is discussed, including the frequency of various twin laws in the plagioclases. Cooling histories, particularly as influencing mineral zoning and degree of crystallization, and pressure histories are important in determining which minerals are present and their composition. A rock classification based on chemical composition is more suited for correlation of these rocks than one based on mineralogy; sixteen chemical analyses are tabulated for rocks of rhyodacitic, dacitic, andesitic, and basaltic composition. Petrological characters and the volumetric distribution of the rock types suggests the differentiation of a basaltic magma, contaminated by granitic material, followed by gravitational selection during extrusion.

R. A. H.

FRIEDMAN (GERALD M.). Structure and petrology of the Caribou Lake intrusive body, Ontario, Canada. *Bull. Geol. Soc. America*, 1957, **68**, 1531-1564, 18 figs., 4 pls.

Possible channels through which magma ascended in this layered mafic intrusive body were located by mapping structural details in the field. However, petrological and geochemical evidence points to a very different differentiation path, suggesting that structural data alone are inadequate to determine the shapes of mafic intrusive bodies. Compositional variations, as determined by optical data, of the following coexisting mineral pairs are shown by linear regression curves: plagioclase-orthopyroxene, orthopyroxene-clinopyroxene, amphibole-plagioclase. Similar curves are shown for the Skaergaard, Baltimore, and Wisconsin intrusive bodies. Chemical variations are presented by means of 6 new rock analyses (picrite, olivine-norite, norite, norite with disseminated pyrrhotite, amphibolite) and spectrographic data for B, Cr, Ni, Co, Cu, and V. Enrichment of plagioclase in sodium, and of pyroxene and olivine in iron and

the variation in major and minor elements during the course of crystallization conform to the pattern observed elsewhere in similarly differentiated rocks. A. L. A.

BARTH (TOM F. W.). *Geology and petrology of the Pribilof Islands, Alaska.* Bull. U.S. Geol. Survey, 1956, **1028-F**, 101-160, 20 figs., 2 pls.

The Pribilof Islands ($57^{\circ}\text{N}.$, $170^{\circ}\text{W}.$) consist predominantly of lava flows and sills of basaltic rock, with minor amounts of pyroclastic tuffaceous material and glacial sediments. Basic dykes are common and a composite aplite dyke [M.A. **12-144**] and a basement of peridotite occur on St. George Island. All the other dykes, flows, and sills are undersaturated in silica and correspond to olivine basalt-basanite. The pyroclastic rocks are mainly basaltic but a small amount of pumiceous glass of rhyolitic composition occurs on St. Paul Island. The tuffaceous material contains fragments of peridotite, clear olivine, black-green hornblende and feldspar cleavage flakes whose partial chemical analyses indicate the unusual composition $\text{Or}_{17}\text{Ab}_{80}\text{An}_3$. Olivine nodules were found in basanite lava and in pyroclastic material and had about 70% olivine ($2V$, 89° , β 1.682), about 30% enstatite ($2V$, 85° , β 1.672) and <1% spinel (n 1.762, a 8.12 Å). Chemical analyses are given of peridotite, tuff, rhyolitic glass, 8 lava flows, and 6 dykes.

R. A. H.

SABINS (FLOYD F., Jr.). *Geology of the Cochise Head and western part of the Vanar quadrangles, Arizona.* Bull. Geol. Soc. America, 1957, **68**, 1315-1342, 3 figs., 3 pls.

The pre-Cambrian basement complex of muscovite and sericite schists and quartzite is intruded by two granites; all these formations are cut by pre-Cambrian aplite dykes. Tertiary rocks include mafic volcanics, rhyolite flows and agglomerate, and welded tuffs, together with quartz monzonite and diorite intrusions. R. A. H.

SHERLOCK (DONALD G.) & HAMILTON (WARREN). *Geology of the north half of the Mt. Abbot quadrangle, Sierra Nevada, California.* Bull. Geol. Soc. America, 1958, **69**, 1245-1268, 2 figs., 7 pls.

The petrology and contact relationships of granitic rocks in part of the Sierra Nevada batholith are described, but no analytical data are given. The origin of dark inclusions near a contact is here clearly due to progressive hybridization of xenoliths of the calcareous metasedimentary wallrock. The xenoliths were amphibolized concentrically; reconstituted to typical dark-inclusion texture and mineralogy; and blocky xenoliths drawn out into spindle shapes. Assimilation of mafic wallrocks by felsic magmas may have caused much of the diversity, but all the granitic plutons were intrusive. A. L. A.

LARSEN (ESPER S., Jr.) & SCHMIDT (ROBERT GEORGE). *A reconnaissance of the Idaho batholith and comparison with the southern California batholith.* Bull. U.S. Geol. Survey, 1958, **1070-A**, 1-33, 1 map.

The Idaho batholith and included inliers of older rocks underlie an area of about 16000 square miles. The average rock is intermediate between a quartz-monzonite and granodiorite. The average rock of the southern California batholith is a tonalite. The Idaho batholith has very little gabbro and contains much more quartz monzonite than the California batholith. The individual bodies of a single kind of rock are much larger in the Idaho batholith than in the southern California batholith. The two batholiths fall very near the same variation curves, are about 108 million years old (middle part of the Cretaceous), and are believed to have been emplaced chiefly by magmatic injection. (Author's abstract.)

K. S.

GROGAN (R. M.). *Present state of knowledge regarding the pre-Cambrian crystallines of Illinois.* Trans. Illinois Acad. Sci., 1949, **42**, 97-102.

Six wells have been drilled into the pre-Cambrian crystallines of Illinois. The well in Boone County was drilled 73 feet into gray granite; one in DeKalb County 639 feet into red granite; two in Lee County into red granite and felsite; and two in Pike County, one into red-brown rhyolite porphyry and the other into red granophyre. The common minerals of the four wells in northern Illinois are quartz, orthoclase, microcline, and biotite. The accessory minerals are apatite, zircon, rutile, magnetite, ilmenite, chlorite, epidote, oligoclase, and andesine. The felsite has been altered to a light green waxy clay, illite-montmorillonite mixed layer clay mineral. The rhyolite porphyry from Pike County consists of large crystals of feldspar and quartz in a fine-grained mass of quartz and orthoclase. Other minerals present are muscovite, biotite, chlorite, pyrite, magnetite, hematite, zircon, and garnet. The large feldspar crystals are microcline, orthoclase, and microperthite.

W. A. Wh.

CLEGG (K. E.) & BRADBURY (J. C.). *Igneous intrusive rocks in Illinois and their economic significance.* Illinois State Geol. Survey, 1956, Rept. Invest. **197**, 19 pp., 1 fig., 6 pls.

The most common igneous rocks in Illinois are altered dykes described as having originally been mica-peridotite or mica-olivinites; sills of this type also occur. Explosive breccias with subangular to rounded fragments of various rocks have a matrix of finely ground rock and mineral fragments which shows no evidence of crystallization in place from a magma. The dykes and sills frequently cut coal seams, where they are bordered by coked and silicified coal.

R. A. H.

REQUHAR (O. C.). *The Pre-Cambrian rocks of Kansas.* Bull. Kansas State Geol. Survey, 1957, **127**, pt. 3, 49–122, 5 figs., 9 pls.

Pre-Cambrian rocks are not exposed in Kansas but the cores of 1600 test wells reaching the basement complex have been assembled and indicate a series of metamorphic rocks which have been intruded by a suite of igneous rocks, mainly granite with some gabbro and syenite and also dolerite and other minor intrusives. The metamorphic group consists mainly of quartzite, quartz-muscovite schist, hyllite, and marble, but also includes foliated granitic gneiss.

R. A. H.

KNOFF (ADOLPH). *The Boulder batholith of Montana.* Amer. Journ. Sci., 1957, **255**, 81–103.

This large plutonic mass extends for seventy miles along the Continental Divide of the Rocky Mountains and has invaded pre-Cambrian to Cretaceous rocks, the youngest pre-batholithic rocks being andesitic and dellenitic lavas and associated pyroclastics. Four chemical analyses are given of these volcanic rocks, together with one of the pre-Cambrian Helena dolomite. The batholith is composite, the order of intrusion being basic hypersthene-bearing granodiorite, granodiorite, porphyritic granodiorite, biotite, adamsite, and muscovite-biotite granite: ten chemical analyses are given. Extensive contact metamorphism has affected the surrounding rocks; the Helena dolomite has been transformed into aphanitic tremolite-diopside hornfels to a maximum distance of 10000 feet from the edge of the batholith; the highest grade of metamorphism is a sillimanite-cordierite-microperthite hornfels. In places the magma has reacted with limestone xenoliths to produce an aureole of augite granodiorite in place of the hornblende-biotite granodiorite. Elsewhere limestone appears to have been dissolved at depth giving alkaline rocks ranging from leucomonzonite to syenodiorite and nepheline shonkinite.

[M.A. **11**–332, **12**–383, **13**–242]

R. A. H.

BUDDINGTON (A. F.). *Interrelated pre-Cambrian granitic rocks, northwest Adirondacks, New York.* Bull. Geol. Soc. America, 1957, **68**, 291–306, 1 fig., 1 pl.

Twenty-one new chemical analyses of northwest Adirondack granitic rocks are presented, comprising three of the predominant hornblende-microperthite granite and equivalent gneiss, nine of alaskite which confirm that the normative quartz content of the alaskite is less than 42%, eight of microcline-rich granitic gneisses, and one of sodic granitic gneiss. The compositions of the granitic rocks as a whole are plotted and their interrelationships discussed: three additional analyses of biotite-quartz-plagioclase gneiss are included. The chemical data are consistent with the hypotheses that the hornblende-microperthite granite, biotite-

microperthite alaskite, and their equivalent gneisses are initially of magmatic origin, and that an inequigranular granite gneiss and sillimanitic microcline-rich granitic gneiss result in part at least from granitization of biotite-quartz-plagioclase gneiss. [M.A. **8**–97, **10**–426]

R. A. H.

TAUBENECK (W. H.). *Geology of the Elkhorn Mountains, northeastern Oregon: Bald Mountain batholith.* Bull. Geol. Soc. America, 1957, **68**, 181–238, 23 figs., 2 pls.

The batholith is a composite intrusive composed of at least eight distinct rock types which range from norite to quartz monzonite: twelve chemical analyses and over 200 modal analyses are presented. The different units were emplaced in a mafic to felsic sequence, with tonalite and granodiorite as gradational facies of the major intrusion representing about 97% of the 171 square miles of exposed batholithic rocks. After the noritic magmas had crystallized, additional magmatic pulses produced the major intrusive mass and three small leucocratic bodies, each later intrusive representing a disconnected magma which crystallized individually. The norite of Willow Lake has an unusual type of banding in which the direction of elongation of individual crystals of each successive layer of plagioclase and mafic minerals is essentially at right angles to the banding. Mineralogical studies covered the frequency of twinning types in plagioclases, size and shape of zircons, and the variation in $2V$ for potassium feldspars and hornblendes in the tonalite and granodiorite. The batholith was intruded into a heterogeneous assortment of Permian sediments and a Triassic metagabbro-serpentine sequence, and is probably Cretaceous in age.

R. A. H.

HUTCHINSON (ROBERT M.). *Structure and petrology of Enchanted Rock batholith, Llano and Gillespie Counties, Texas.* Bull. Geol. Soc. America, 1956, **67**, 763–806, 18 figs., 10 pls.

The Enchanted Rock batholith is a pluton of moderate size intruded into tightly folded pre-Cambrian metamorphic rocks; age determinations give an age for the batholith of 815 m.y. It consists of four concentric zones which, from the outer core, are leucogranite and granite, granite and quartz-monzonite, quartz monzonite and alkalic granodiorite, and leuco-quartz monzonite and leucogranite; chilled border rocks are leuco-quartz monzonite and quartz monzonite. The normative constituents of the rock zones are strikingly grouped about a composition having a 1:1:1 ratio of albite: orthoclase: quartz. Mineralogically the systematic gradation suggests that unmixing of sodic plagioclase from microcline was a dominant process; considerable attention is given to the plagioclase-microcline relationships.

R. A. H.

BLOOMER (ROBERT O.) & WERNER (HARRY J.). *Geology of the Blue Ridge region in central Virginia.* Bull. Geol. Soc. America, 1955, **66**, 579-606.

The basement complex includes various quartzo-feldspathic gneisses and an oval body of monomineralic rock, the Roseland anorthosite, with plagioclase of composition An₃₀. Nelsonite, consisting of ilmenite and apatite in roughly equal amounts [U.S. Geol. Surv. Prof. Paper 198], forms dyke-like bodies along the contact of the anorthosite with the gneiss. The conformable late pre-Cambrian Catoctin greenstone is classified as a spilite. R. A. H.

WEAVER (JOHN D.). *Utuado pluton, Puerto Rico.* Bull. Geol. Soc. America, 1958, **69**, 1125-1142, 5 figs., 2 pls.

The Utuado pluton is emplaced among Upper Cretaceous volcanic and sedimentary rocks in north-central Puerto Rico. It consists mainly of granodiorite and quartz diorite; minor amounts of quartz porphyrite and gabbro occur marginally. Present evidence suggests these rocks were formed by reconstitution of pre-existing sediments in a trough, without, in the main, passing through a liquid state. Analyses and norms, but not modes, are given of gabbro (1), quartz monzonites (2), quartz diorites (2), andesite (1), quartz porphyrite (1), and granodiorite (1). A. L. A.

CHOURBERT (BORIS). *Sur deux variétés de granites observées en Guyane française.* C.R. Acad. Sci. Paris, 1955, **241**, 1405-1407.

Two granites belonging to the upper pre-Cambrian of French Guiana form masses of moderate size. One, of fine grain with clear directional structure, contains microcline, acid plagioclase and biotite. The other, with potassic bias, has the same mineral composition but is of coarser grain and non-directional. An aureole in intensely metamorphosed schists surrounds the two masses. In spite of these analogies, tectonic, stratigraphical and metallogenetic differences prompt the belief that two successive events are in question.

E. J. & A. S.

Petrology : structure, processes

WILSON (H. D. B.). *Structure of lopoliths.* Bull. Geol. Soc. America, 1956, **67**, 289-300, 10 figs.

Field studies of five large differentiated lopolithic intrusions show that they possess many similar features. The bottoms of the intrusions are irregular and are not parallel to the layering but in general dip more steeply towards the centre. The lopoliths are interpreted as being funnel-shaped in cross section with the most basic rocks in the lower portion; the upper portion may be similar to some batholithic granites, with the overlying roof rocks displaying orogenic folding in contrast to the gently warped underlying formations. R. A. H.

CAMERON (E. N.) & ABENDROTH (H. E.). *Structure of lopoliths: discussion.* Bull. Geol. Soc. America, 1957, **68**, 1063-1066.

Detailed mapping of the eastern part of the Bushy complex has disclosed features at variance with suggestions advanced by Wilson [preceding abstract]. The thickness of ultrabasic rocks below the Merensky Reef in the St. poort bulge is questioned and it is suggested that if, further north, the base of Hall's diabase is taken as the floor of intrusion, transgressions by the lower contact of the intrusion are eliminated. G. D. N.

WILSON (H. D. B.). *Structure of lopoliths: a reply.* Bull. Geol. Soc. America, 1957, **68**, 1067-1070.

Discussion of above contribution and reply to point raised. G. D. N.

HAMILTON (WARREN). *Yellowstone Park area, Wyoming: possible modern lopolith.* Bull. Geol. Soc. America, 1959, **70**, 225-228.

The geological data pertaining to the rhyolite plateau of Yellowstone National Park is reviewed. The composition, frequency distribution, association with basalt with intermediate rocks, and the tectonic association of the rhyolitic rocks, are believed to be so consistently different from those of andesitic suites or batholithic granitic rocks that a quite different origin is indicated. However, the rhyolites are similar in composition and uniformity to the 'red rocks' of the Duluth, Wichita, and Bushveld lopoliths. It is suggested that the rhyolites are the foundered, capping 'red rocks' of a lopolith, the mafic bulk of which is hidden by its felsic differentiates. A. L. A.

WAGER (L. R.) & BROWN (G. M.). *Funnel-shaped layered intrusions.* Bull. Geol. Soc. America, 1957, **68**, 1071-1074.

WILSON (H. D. B.). *Terminology of layered intrusions.* Bull. Geol. Soc. America, 1957, **68**, 1075.

The authors of these two papers discuss the terminology to be used in describing igneous intrusions. Wager and Brown suggest that lopolith is an inappropriate term for intrusions having the shape of an inverted cone and suggest its restriction to bodies emplaced through a local downfaulting of the crust. Wilson concedes that funnel intrusion is perhaps a better description of igneous intrusions of inverted cone form. G. D. N.

[LAPIN (V. V.) & KURTZEVA (N. N.). Лапин (В. В.) и Курцева (Н. Н.). Дифференциация силикатных расплавов производственных условиях и их геологическое значение [Differentiation of silicate melts under industrial conditions and its geological significance.] Изв. Акад. Нauk ССР, Сер. Геол. [Bull. Acad. Sci. U.S.S.R., Сер. Геол.], 1958, no. 5, 50-59, 10 figs.]

Experiments on slags from a nickel smelting furnace were made in ladles of some twenty-five tons capacity and the holding period was five days. In one instance the upper part of the slag mass showed an accumulation of olivine richer in iron than the olivine found in the lower part. In the second case the olivine from the rock used in the furnace charge has accumulated, to the extent of 30%, in the lower part of the slag rendering it highly viscous. S. I. T.

ILLEY (C. E.). *Problems of alkali rock genesis*. Quart. Journ. Geol. Soc. London (Thirteenth William Smith Lecture), 1958 (for 1957), **113**, 323–360, 12 figs., 6 pls.

The dependence of magma chemistry on tectony is discussed, followed by an account of the application of recent experimental hydrothermal equilibrium studies on alkali-lumina-silicate systems to the nepheline-syenite problem. The relationship between hypersolvus and subsolvus nepheline-syenites, and phonolitic lavas, the importance of potash-nalcime, and the problem of the feldspar thermal barrier which still separates the granite from the foyaite sink at high water-vapour pressures, are among the main points of discussion. Minimum melting curves for foyaite, nepheline-labite, and syenite at variable water-vapour pressures are presented. Many alkali igneous complexes are briefly described and classified, and hypotheses on the causes of transition from nepheline-syenite to granite, and vice versa, are considered and shown to be still somewhat speculative. The status of the carbonate syntaxis hypothesis is examined, and also the manner in which alkali magma might be derived from the deeper levels, e.g. through decomposition of high-pressure minerals. Nephelinization is considered in relation to a belt of nepheline rocks near York River, east of Bancroft, Ontario, in the southern part of the high-grade metamorphic gneiss terrain of the Hastings Highlands. A 570 ft drill-core includes most of the belt, and 36 ft of the underlying Grenville limestones and calc-silicates which flank it conformably. Detailed petrographical and mineralogical descriptions are based on over 1500 thin sections. There are chemical analyses of eight rocks and two minerals (biotite and ferrohastingsite). Replacement textures (illustrated) are common, and it is believed that metasomatic solutions originating from a magmatic source at depth converted pure and impure limestones into this nepheline-bearing assemblage of gneisses. By calculating the compositional differences between the gneisses and limestone, it is shown that the solutions have introduced the components of nepheline, feldspar, and iron minerals into the sediments. Magmatic feldspathoid intrusives and pegmatites are present in neighbouring areas. G. M. B.

SUNDIUS (N.). *Alkaline rocks and carbonates of alkalies, calcium and magnesium*. Arkiv. Min. Geol. Stockholm, 1957, **2**, 319–331, 7 figs.

Investigations of the systems $\text{Na}_2\text{CO}_3-\text{K}_2\text{CO}_3-\text{CaCO}_3-\text{SrCO}_3-\text{BaCO}_3$ are reviewed and the possible roles played by the double carbonates of the types $(\text{Na}, \text{K})_2\text{Ca}(\text{CO}_3)_2$ and $(\text{Na}, \text{K})_2\text{Ca}_2(\text{CO}_3)_3$ during the differentiation of H_2O - and CO_2 -containing magmas, as well as during an assimilation of carbonate rocks by a magma, are pointed out. The alkali carbonates may act as dissolving media for CaCO_3 and MgCO_3 , forming a highly mobile solution with a melting temperature probably about 600°C . This is related to Daly's theory of nepheline syenite as a derivative of the syntaxis of a magma and carbonate rocks. However, the difficulties encountering this theory in the absence of carbonates are stressed, and exemplified by some small, isolated occurrences of calcite-bearing pegmatite and syenite in ordinary acid rocks of the Swedish Archean. The author interprets these calcite-bearing rocks as purely magmatic and formed through local accumulation of low melting carbonate compounds. The probable reactions during the cooling of liquids are outlined, and their products are shown to be in accordance with the actual mineralogical development of the rocks, which have been carefully studied microscopically. As to the origin of nepheline syenites the author considers both ways possible, through assimilation or differentiation, but he also points out that in both cases magmatic solutions are involved and hence the double carbonates of calcium, magnesium, and alkalis probably have an important role.

K. F.

[ХИЛЬТОВ (Ю. Н.)] Хильтов (Ю. Н.). Главнейшие этапы формирования кимберлитов. [Principal stages in the formation of kimberlites.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **123**, 534–537.

Two principal stages are suggested: (1) magmatic, during which mica-kimberlite is followed by normal kimberlite, and (2) extrusive, in which the explosive activity is the predominant factor.

S. I. T.

[МОСКАЛЕВА (С. В.)] Москалева (С. В.). О генезисе некоторых гипербазитов Урала. [On the genesis of certain hyperbasites of the Urals.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **123**, 148–151, 4 figs.

A detailed study of a gradational rock series of dunite-pyroxenite-gabbro, widely distributed in the Urals, suggests that dunite was formed through the process of metasomatic olivinization of pyroxenite by mobile magmatic emanations.

S. I. T.

EARLEY (J. W.). *On chlorine in serpentinized dunite*. Amer. Min., 1958, **43**, 148–155, 2 figs.

Serpentinized pre-Cambrian dunites from Ontario, Canada, contain several tenths % chlorine while peridotites and pyroxenites, which are associated, show a nearly normal

amount of chlorine, about 0·04%. The chlorine in the dunite is fairly soluble in hot water and readily soluble in cold dilute sulphuric acid, except for a few hundredths %. It is suggested that the readily soluble chlorine was introduced into the rock during serpentization by chloride-rich solutions from adjacent sediments and tuffs. The difficultly soluble chlorine is probably entrapped in silicate crystals.

A. P.

BATTEY (M. H.). *The petrogenesis of a spilitic rock series from New Zealand.* Geol. Mag., 1956, **93**, 89–110, 1 pl., 4 figs., 5 tables.

A detailed petrographic description of the spilite series is accompanied by four new analyses of spilites, one analysis of a green chlorite, and optical data for augite, babingtonite, pumpellyite, and the analyzed chlorite. The petrography and analyses indicate close similarity between spilites and tholeiites; plots of Ca : Na : K and Fe : Mg : Alk are given demonstrating this similarity, except for a deviation in the early part of the Ca : Na : K curve. The petrogenesis of spilites is discussed in detail, the proposed interpretation being based on the work of Yoder [M.A. **12**–83]. Metastable augite (not pigeonite) crystallized with albite under hydrous conditions, followed by iron-rich chlorite and quartz. Retention of volatiles is accompanied by retention of alkalies and iron; neither introduction of soda nor peculiar initial magma is required on this hypothesis. The existence of a spilitic series from 'dry tholeiite' via 'wet tholeiite' to 'spilite' is discussed and considered likely. R. St J. L.

RITTMANN (A.). *Geosynclinal volcanism, ophiolites and Barramiya rocks.* Egypt. Journ. Geol., 1958, **2**, 61–65.

The author discusses the formation of ophiolites by the hydration of the crystallizing minerals during deep-sea eruptions of basaltic magmas. At great depth CO₂ and other volcanic gases escape from the lava and form with the sea water pneumatolytic and hydrothermal solutions, thus causing carbonation of the lavas and transforming picrites into Barramiya rocks and andesine basalt into spilites, etc. The effects of regional metamorphism on ophiolites are also presented.

E. M. El S.

WAHLSTROM (ERNEST E.). *Petrology and weathering of the Iron Dike, Boulder and Larimer Counties, Colorado.* Bull. Geol. Soc. America, 1956, **67**, 147–163, 9 figs., 4 pls.

The Iron Dike is a magnetite-rich diabase which has suffered deuterian alteration by late residual solutions. Weathering of the dyke has caused extensive oxidation and hydration of iron-bearing minerals, especially pyroxene and chlorite, and downward transportation and deposition of colloidal limonitic material: considerable calcium and magnesium have been removed from the upper part of the

weathered zone by leaching. Analyses and optical data given for two clinopyroxenes from the centre of the dyke for four fresh and six weathered diabase samples, and for fresh and weathered granodiorite in the vicinity of the dyke.

R. A. H.

JAEGER (J. C.). *Temperatures outside a cooling intrusion sheet.* Amer. Journ. Sci., 1959, **257**, 44–54.

Temperatures are calculated for the contact, for points various distances from it, and for various times after intrusion, allowing for the following factors: initial temperature of magma, latent heat of crystallization, thickness of sheath, pore-water in sediments intruded, possible variations in conductivity, and movement of pore-water. Possible 'post-heating' of country rock, due to superheat or to continual renewal of the magma, may account for the thin baked layers observed at some contacts, and results of the study would not be valid within such baked layers, but should hold nevertheless at points more distant from the contact.

H. W.

BARTH (T. F. W.). *Température de formation de certains granites précambriens de Norvège Méridionale.* Science de la Terre, 1955, no. hors série, 119–127.

Information on the distribution of soda between the alkali feldspars and the plagioclases indicates that the granitic gneisses of the pre-Cambrian of southern Norway have recrystallized at 350°C. Small areas of granite with irregular and diffuse marginal relations to the gneisses have crystallized at 400°C; granitic masses with clean margins have crystallized at 500°C. The feldspars of the augen-gneisses have formed between 400° and 500°C and the feldspars of the pegmatites between 450° and 575°C [M.A. **14**–148].

E. J. & A. S.

WALKER (FREDERICK). *Ophitic texture and basaltic crystallization.* Journ. Geol., 1957, **65**, 1–14, 3 figs.

A micrometric study of dolerites and tholeiites shows that the ophitic texture bears only a rough relationship to the mineralogy, but that the more extreme examples of the texture are found in olivine-dolerites with a low pyroxene:feldspar ratio. In tholeiitic suites both pyroxene and plagioclase start to form at a very early stage and continue to crystallize in ophitic relationship and in fairly constant proportion throughout the cooling history. In olivine-dolerites, however, olivine or plagioclase is the first mineral to form, being followed much later by pyroxene. [M.M. **29**–913, 925]

R. A. H.

DAVIES (R. G.). *The Pen-y-gader dolerite and its metasomatic effects on the Llyn-y-gader sediments.* Geol. Mag., 1959, **93**, 153–172, 4 figs.

The chemical and mineralogical changes produced through the autometasomatism of the 300 ft thick sill and the metasomatism of roof, fine-grained floor, and coarse-grained floor sediments (chiefly mudstones), are traced with the aid of 11 new chemical analyses each made for 11 major elements. The main metasomatism involved the introduction of sodium, with small amounts of boron and fluorine, into the sediments. Sodium is concentrated for about six feet below the contact for fine-grained sediments, and (due to greater porosity) for about eighteen feet for coarse-grained sediments.

G. M. B.

HUGHES (C. J.), WADSWORTH (W. J.), & EMELEUS (C. H.). *The contact between Tertiary granophyre and Torridonian arkose on Minishal, Isle of Rhum.* Geol. Mag., 1957, **94**, 337-339, 1 pl.

This apparently gradational contact has previously been used as evidence for the formation of granophyre from arkose by metasomatic alteration in situ. Re-examination shows it to be a tectonic junction, the effects of crushing being obscured at this locality through later heating by an intrusive gabbro. [M.A. 12-543]

G. M. B.

WHITTEN (E. H. T.). *The petrogenetic significance of the contact relationships of the Donegal granite in Gweedore and Cloghaneely.* Geol. Mag., 1957, **94**, 25-39, 8 figs.

Four contacts, between 'Older granite' and Dalradian quartzites, have been examined for structural, textural, and modal changes across the contacts. Gradational changes sometimes occur within a narrow zone (4 ft or so), and involve a culmination of plagioclase in the granite margin and introduction chiefly of K and Al into the quartzite. However, some contacts are sharp, due to scouring by the granite magma. The conclusion is that the granite was intrusive and magmatic, but that metasomatic 'fronts' developed at some contacts on a small scale. G. M. B.

MATHIEU (F. F.). *Les dykes basaltiques du bassin houiller de Kaiping et leur influence sur les roches encaissantes.* Publ. Assoc. Étude Paléont. Stratigr. Houillères, Brussels, 1955, no. **21**, 21-45, 7 figs.

Ten vertical or steep dykes of limburgite (one analysis), 0·2-1·2 m. thick, cut weakly inclined coal seams at Linsi and Tang Chia Chwang, China. The width of the alteration zone is less than 1 m. Cinder coal and columnar structure are developed. Volatile matter content (unaltered coal : 26·5-35·1%) is decreased to 9·1-16·3% at the contact.

R. V. T.

HENSON (F. A.) [1919-1957]. *Contact phenomena from N.W. Jersey, C.I. [Channel Islands].* Geol. Mag., 1956, **93**, 473-484, 1 fig.

Well-exposed contacts between an Armorican biotite-hornblende granite and pre-Cambrian greywackes are briefly described. The granite is mineralogically zoned within 6 inches of the contact and often contaminated, while the sediments have become biotite hornfels. The distribution of 18 trace elements has been studied in 28 rocks across the contacts. There is a concentration of most elements, but particularly Sr, Ba, and Rb, in the sediments within a few inches of the contact, and a rhythmic variation in their distribution.

G. M. B.

WOODARD (HENRY H.). *Diffusion of chemical elements in some naturally occurring silicate inclusions.* Journ. Geol., 1957, **65**, 61-84, 17 figs., 2 pls.

In the York area, Maine, rocks of the Agamenticus alkaline ring-dyke complex include, from oldest to youngest, hybrid alkaline granite, alkaline syenite (nordmarkite), alkaline granite, and granodiorite. The nordmarkite and the alkaline granite contain inclusions of the country rocks ; an alternating series of impure limestones now metamorphosed to a diopside-hedenbergite, tremolite-actinolite, plagioclase, orthoclase-rock, and subgreywackes now metamorphosed to a quartz, biotite, muscovite, orthoclase, andesine-rock. A detailed investigation has been made of the chemical and mineralogical changes produced in the reaction between these inclusions and the igneous complex : the oxides of the elements demonstrate geochemical depression or culmination in a specific zone or a gradual increase or decrease from the centre of the inclusion outward. Throughout the history of alteration silicon and the basic constituents including iron move outwards towards the borders of the inclusions ; this behaviour, especially with regard to iron, is in contrast to the predictions of Reynolds [M.A. 10-87]. The alkalis all move into the inclusions from the surrounding melt. Sixty-five spectrographic analyses for major elements are presented, SiO₂ being determined by difference ; in addition fifty-four specimens were analysed for trace elements ; the analytical results are presented graphically. [M.M. 22-494 ; M.A. 11-496]

R. A. H.

Petrology : various

RAMBERG (H.). *Mécanisme de formation des pegmatites dans l'Ouest de Groenland.* Sciences de la Terre, 1955, no. hors série, 25-80.

Pegmatite dykes are met in the gneisses, crystalline schists, amphibolites, diopside skarns and ultrabasic rocks. They are formed either by replacement without increase of volume, or by filling fissures on expansion ('dilating fissures'). Often pegmatites form ptygmatic folds or boudinage structure ('pinch and swell'). They have formed by diffusion of the most mobile chemical constituents of the lithological complexes.

E. J. & A. S.

RAMBERG (HANS). *Pegmatites in West Greenland.* Bull. Geol. Soc. America, 1956, **67**, 185-214.

Numerous quartz-feldspar pegmatites occur in the gneisses and crystalline schists, some being volume-by-volume replacement bodies while others formed by slow growth in dilating fissures. Both varieties were emplaced by diffusion through the host rocks and fissures, field evidence being against bodily flow of pegmatite magma. Localization of pegmatites was controlled by tension joints, shear zones, pre-pegmatitic dykes and inclusions in the gneiss; ptygmatic folding and pinch-and-swell structures are results of tectonic deformation simultaneous with or later than the formation of the pegmatites. [M.A. 11-26] R. A. H.

LJUNGGREN (P.). *Complete and incomplete granitizations.* Geol. Fören. Förh. Stockholm., 1956, **78**, 642-644.

The author divides the granitic rocks into three different groups. The first group contains remnants of the pre-existing rocks and is a result of incomplete granitization. The second group are those granites which cannot directly be proved to be either magmatic or a result of feldspatization-granitization; they represent a complete granitization. The third group are the granites of magmatic origin.

E. Å-n.

TUTTLE (O. F.). *L'origine et la classification des granites à la lumière des études expérimentales dans le système NaAlSi₃O₈-KAlSi₃O₈-SiO₂-K₂O.* Sciences de la Terre, 1955, no. hors série, 299-309. E. J. & A. S.

TUTTLE (O. F.). *Degré géothermique et magmas granitiques.* Sciences de la Terre, 1955, no. hors. série, 87-99.

Increase of the geothermal gradient of the order of 6°C/km up to a temperature of 600°C would be the result of the diminution of the conductivity of minerals as a function of temperature—a factor more important than pressure and radioactivity (opposite effect). The principal source of heat would be below the sial. Fusion of a rock possessing the composition of granite would begin about 600°C (if sufficient water were present) and at a depth of 10 to 40 km.

E. J. & A. S.

REYNOLDS (D. L.). *Granite: some tectonic, petrological and physico-chemical aspects.* Geol. Mag., 1958, **95**, 378-396.

A classification of the author's views on the origin of granites. The development of the idea that orogenic processes greatly influence the mobilization and flow of granite is traced. The high-level potash-granites and microgranites are believed to be derived by the addition of potash and silica to more sodic rocks, such as granodiorites, through reaction between aqueous solutions and crystalline rocks.

The process of transformation may have been one of fluidization, with temperatures high enough to cause melting. Bowen and Tuttle's experimental work on the system quartz-orthoclase-water is discussed and re-interpreted. The fact that decreasing pressure of H₂O results in quartz-orthoclase enrichment, in the system, supports the idea of potash-granite formation at higher levels. The term *minimite* proposed for the rock which begins to crystallize at the lowest temperature, for a given pressure, in the system.

G. M. B.

RANKAMA (K.). *Les processus chimiques 'en grand' dans la croûte terrestre.* Sciences de la Terre, 1955, no. hors série, 273-279.

The author gives a brief general review of geochemical differentiation in the crust of the earth and examines recent evidence for these processes, attaching special importance to the balance-sheet of the chemical evolution in the crust. (Author's abstract.)

E. J. & A. S.

DEMAY (ANDRÉ). *Sur les conditions physiques des déplacements de matière et des crystallisations qui aboutissent à la formation d'un massif granitique.* Sciences de la Terre, 1955, no. hors série, 249-267.

An examination of the conditions of depth and pressure for granites of the upper crust and granites at depth. Except for small dikes of microgranite, pegmatite, aplite and possibly rare exceptions, there has never been intrusion of a granitic magma. Granite is formed in place by digestion or by transformation of the pre-existing terrain. Definition is attempted of the physical conditions of formation of the two kinds, (1) magmatic—with previous homogenization into the state of glass, and (2) metasomatic—by crystallization of aggregates (physical and chemical data for natural and industrial glasses and on devitrification are given; experiments on the synthesis of the minerals of granite and metamorphic aureoles; field and microscopic observations described). Temperature of homogenization is taken as between 750° and 850°C. The temperature and the content of water may have varied in the two cases, by 1 to 2%. Viscosity of magma formed in place reaches probably 10⁶ to 10⁷ poises; it was a glass. Some examples of the convergence of facies of the two kinds of granite are given.

E. J. & A. S.

WEGMANN (EUGÈNE). *Les ordres de grandeur dans les phénomènes métasomatiques des roches.* Sciences de la Terre, 1955, no. hors série, 169-174.

Metasomatic phenomena are considered from two points of view: (a) movement in the crystalline fabric and in the solid rock surround; (b) channels and manner of travel of the exchanged materials. Investigation requires methods and

techniques adapted to each scale of transformation, and principles allowing coordination of the results in space and time. (Author's abstract.)

E. J. & A. S.

JOE-NYGAARD (ARNE). *Comparaison entre les roches grenues appartenant à deux orogénies précambriennes voisines au Groenland*. Sciences de la Terre, 1955, no. hors série, 61-72.

Normal granitization is above all a process in which the ions are transported by diffusion in solutions which fill the pores and sub-capillary spaces and in which tectonic movements during orogenesis behave directly as catalysts of recrystallization. In the deeper levels of degranitization, rarely exposed by erosion, the last effects of extreme conditions of pressure and temperature favour diffusion to small distance in the solid state tending to rocks of coarse grain of quartz-dioritic composition. In these rocks each mineral species has attained almost the same dimensions.

E. J. & A. S.

PERRIN (RENÉ). *Remarques sur les voies de recherche de la synthèse des granites*. C.R. Acad. Sci. Paris, 1955, **241**, 1897-1901.

Observations, still incomplete, show that artificial granitization should be realizable, though after much experimentation, provided procedure is systematic and use is made of the principle of 'diffusions à double sens' [two-way diffusion, Ed.]. It cannot really be affirmed that synthesis of granite has been achieved unless the texture of granite has been reproduced as well as the usual minerals of granite developed.

E. J. & A. S.

PERRIN (RENÉ) & ROUBAULT (MARCEL). *Granites à enclaves dites déplacées et naissance in situ de schistosités discordantes ou contournées*. Sciences de la Terre, 1955, no. hors série, 105-118.

The existence of these enclaves is very often considered an argument in favour of a magmatic origin for granite. The authors set out a hypothesis according to which granitization and gneissification are contemporaneous or belong to the one metamorphic cycle ; schistosities have been able to develop directly without the discordances and contortions being the result of subsequent deformation. Observations from France and Sweden.

E. J. & A. S.

RAGUIN (EUGÈNE). *Texture originelle et migrations chimiques dans la gneissification d'un poudingue pyrénéen*. Sciences de la Terre, 1955, no. hors série, 17-21.

The gneiss of Peyregrand in the Pyrenees of Ariège passes laterally into Primary [Palaeozoic] strata. Its paragenesis and its chemical composition are granitic ; its formation has required a considerable addition of alkalis. In the light of

its structure and of that of the intercalated granitized layers of quartzose conglomerates the migration of the various chemical substances is discussed. Analyses : A, 'normal' gneiss ; B, cement of the conglomerate.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	K ₂ O	H ₂ O+	Total
A	74.40	0.15	14.05	0.41	0.89	0.79	0.15	0.06	3.42	4.22	0.94	100.34
B	77.00	0.13	12.50	0.46	0.74	0.61	0.20	0.08	3.04	4.56	0.90	100.27

Totals include P₂O₅ 0.11, 0.05 ; CO₂ 0.65, — ; H₂O — 0.10, 0.00 respectively.

E. J. & A. S.

LAFFITTE (PIERRE). *Le granite de Bréhat et ses phénomènes de contact*. Bull. Serv. Carte géol. France, 1955, **53**, 244, 1-24.

Almost all the area north of Tregorros is formed of the granite of Perros-Guirec (Côtes du Nord), to the south of which in the eastern part lie thick series of acid lavas. Study of these rocks has shown the existence of every stage of structure intermediate between normal lavas or microgranular rocks and granite. This transformation of lavas by progressive recrystallization into rocks with the structure of granite does not necessarily belong to one and the same magmatic episode and the granite of Bréhat probably corresponds to a later cycle (? Hercynian). Eleven chemical analyses include 5 of granites, 4 of rhyolitic lavas, 1 of a microgranite, and 1 of a hornfels enclave in the granite. Twelve very incomplete analyses formerly carried out by Ch. Barrois are quoted.

E. J. & A. S.

JUNG (JEAN). *Contribution à l'étude du mode de formation de la durbachite de Sainte Croix-Aux-Mines (Haut-Rhin)*. Sciences de la Terre, 1955, no. hors série, 77-84.

This durbachite is a rock resembling an augengneiss composed of porphyroblasts of microcline embedded in a matrix which is essentially micaceous (biotite + amphibole) without quartz. It occurs as a passage zone between gneiss and granite, and is a gneiss locally enriched in Fe, Mg, Ca, and K in the aureole of a granitic mass. This mode of origin accords with D. Reynolds's theory of a caffemic front. Five analyses are quoted of which 3 are new by P. Blot ; A, leptynitic gneiss, Ste. Croix ; D, granite of the Crêtes, pale-coloured type ; E, fine-grained granite, Eschbach (Haut-Rhin).

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MgO	CaO	Na ₂ O	K ₂ O	H ₂ O+	H ₂ O-	Total
A	72.8	1.40	14.5	0.39	1.50	0.93	1.20	1.80	5.24	0.45	0.30	100.62
D	67.9	0.47	16.70	2.67	1.94	1.18	1.22	3.50	4.88	0.15	0.20	100.44
E	73.0	0.13	16.70	0.65	0.42	0.25	0.45	3.65	4.90	0.19	0.17	100.85

The totals include P₂O₅ 0.11, 0.23, 0.34 for A, D, and E respectively.

E. J. & A. S.

VAN BILJON (S.). *L'origine des structures rubanées dans la partie basique du complexe du Bushveld*. Sciences de la Terre, 1955, no. hors série, 131-148.

A sedimentary formation, about 6000 m. thick, of alter-

nating shales, quartzites and calcareous rocks has been transformed by metasomatism into a basic complex with banded structure.

E. J. & A. S.

VAN BEMMELEN (R. W.). *Quelques remarques sur les fronts basiques*. Sciences de la Terre, 1955, no. hors série, 311-312.

E. J. & A. S.

DEMAY (ANDRÉ). *Sur les observations qui permettent d'écartier, sauf peut-être dans les cas exceptionnels, l'hypothèse d'une intrusion magmatique, au cours de la genèse des massifs de granite*. C.R. Acad. Sci. Paris, 1955, **241**, 1148-1150.

According to the author's observations intrusion of a magma is an act which does not occur or happens quite exceptionally in the genesis of a granitic massif.

E. J. & A. S.

KING (B. C.). *Syénitisation de granites à Semarule, près de Molepolole, Protectorat du Bechuanaland*. Sciences de la Terre, 1955, no. hors série, 1-13.

The granite, porphyritic or microgranular (with biotite

VTELENSKÝ (Jiří). *Výskyt nikl-kobaltových rudních minerálů v Pekle u Habru*. [The occurrence of nickel and cobalt ore minerals at Peklo near Habry.] Časopis pro mineralogii a geologii, 1956, **1**, 270-280, 2 pls. (Russian and English summaries.)

Partly serpentinized peridotite at Peklo near Habry (eastern Bohemia) is locally penetrated with pyrrhotite and a mineral of the linnaeite group, probably siegenite. The latter is partly changed to millerite. In a vein following the contact of peridotite and gneiss pyrrhotite is accompanied by marcasite and pyrite with accessory sphalerite, niccolite, molybdenite, gersdorffite, chalcopyrite, arsenopyrite, and ilmenite. Mineragraphic, roentgenometric, and spectrographic data are given.

F. S.

SOBOTKA (Jiří). *Chalkostibit CuSbS₂, nový minerál pro ČSR* [Chalcostibite CuSbS₂, a new mineral for Czechoslovakia]. Casopis pro mineralogii a geologii, 1956, **1**, 269. (Russian and English summaries.)

At Krásná Hora in middle Bohemia, auriferous stibnite veins contain acicular crystals and fine-grained aggregates of chalcostibite in paragenesis with arsenopyrite and pyrite, often also with primary gold and tetrahedrite.

F. S.

SOBOTKA (Jiří). *Zpráva o nových výskytech minerálů na zlatonosných zilách středočeských* [Note on new mineral occurrences on the auriferous veins of Middle Bohemia]. Časopis pro mineralogii a geologii, 1956, **1**, 299-300.

and hornblende), passes from margin to centre progressively to syenite, porphyritic or fluxional (leucocratic or white) aegirine-augite accompanied at times by melanite). This syenitization is effected by feldspathization and by introduction of lime and CO₂; the phenomenon can be compared with fenitization.

E. J. & A. S.

NIEUWENKAMP (W.). *Tableau de théories pétrogénétiques*. Sciences de la Terre, 1955, no. hors série, 295-298.

E. J. & A. S.

SEMENENKO (N. P.). *Classification universelle des roches magmatiques*. Sciences de la Terre, 1955, no. hors série, 239-245.

The author establishes a universal scheme based on division into families according to the characteristic mineral species, then into facies among which the idea of neotype and palaeotype is a factor, and lastly into branches according to the proportions of K₂O, Na₂O, CaO, MgO, FeO, and Al₂O₃. A new type 'amagnesian' is represented by leucocratic rocks.

E. J. & A. S.

TOPOGRAPHICAL MINERALOGY

Auriferous veins of Jilové contain sphalerite, veins Radlik pyrrhotite and tetrahedrite, veins of Krásná Hora all these three minerals. Tetrahedrite of Krásná Hora is in some cases enclosed in metallic gold.

F. S.

BOUŠKA (VLADIMÍR) & ČECH (FRANTIŠEK). *O některých tetraheditech z Českomoravské vysočiny* [On some tetrahedrites from the Bohemo-Moravian Highland]. Časopis Moravského Muzea, 1956, **41**, 49-60. (Russian and German summaries.)

Chemical and roentgenometric investigation of tetrahedrites from ore veins of western Moravia. Tetrahedrite from Nedvědice, with contents of Ag and Bi, has a high constant of a 10.368. Tetrahedrites from Jihlava and Dobrá Voda are freibergites with high silver content. Tetrahedrite from Javůrek belongs to the As-containing variety. The formerly described tetrahedrite from Koroužné has been proved as bournonite by its powder diffraction patterns and the analysis made by J. Pelíšek: Pb 41.3, Sb 24.74, Cu 12.80, Fe 0.95, Zn 0.24, Ag trace, S 18.3, SiO₂ 1.41, = 99.82. In and Cd are possibly homogeneously admixtures in the tetrahedrites.

F. S.

KRUŠA (TOMÁŠ). *Příspěvky k moravské topografické mineralogii VI*. [Contributions to the topographical mineralogy of Moravia VI.] Časopis Moravského Muzea, 1956, **41**, 5-30. (Russian and English summaries.)

Numerous additions to new occurrences of minerals

oravia. New for Czechoslovakia are hawleite, isometric β S, in andesite of Komna near Bojkovice (S.E. Moravia), determined by P. Černý, and högbomite from Onšov near Lanov in S.W. Moravia, in pyroxenic peridotite. A revision of Moravian minerals described as spodumenes from Čichov and Vernířovice has proved that they are diopside (J. Šíkovský).

F. S.

KRDLIČKA (ZDENĚK) & KUPKA (FRANTIŠEK). *Identifikace rammelsbergitu z Křížan u Liberce* [Identification of rammelsbergite from Křížany near Liberec.] Časopis pro mineralogii a geologii, 1956, **1**, 217–222.

In veins of ankerite, baryte, and fluorite grains of rammelsbergite occur with younger pyrite. Anal.: Ni 20·62, As 7·21, Fe 0·31, S 0·66, Sb tr., insol. 5·29; calculated omitting insol.: Ni 21·72, Co 7·59, As 69·68, Fe 0·32, S 0·69, Sb tr., = 100·00. Roentgenometric data are given.

F. S.

AK (LUBOR). *Alabandin z Litošic v Železných horách* [Alabandite from Litošice in the Železné hory—Iron Mts.] Rozpravy Československé Akad., 1956, **66**, no. 13, 49–79, 19 figs. (Russian and English summaries.)

Graphitic and pyritic slates of Algonkian age with a discordant body of rhodochrosite between Litošice and Vápenka (eastern Bohemia) are penetrated by a brecciated vein containing four generations of rhodochrosite, two of labandite, opal and pyrite partly contemporaneous with younger alabandite, and later neotocite, ankerite, quartz, and chalcedony. The alabandite is of green colour, a unique occurrence. Its first generation crystallized in cigar-shaped individuals, its second in granular aggregates. Qualitative spectrographic analysis proved subordinate to insignificant quantities of Ge and Mg, and only traces of Fe and Ga. Powder pattern analysis of alabandite from Litošice gave results agreeing with the data for alabandite—Sacaramb Nagzag). D.t.a. curves of synthetic MnS and of alabandites from Litošice and Sacaramb are given and discussed. Neotocite is rare; its refractive indices have been determined: $1\cdot603 \pm 0\cdot004$ for isotropic parts, about 1·47 for lighter, isotropic ones. The usual black-brown colour of natural labandite from other localities seems to be difficult to explain. One possibility may be the presence of higher oxidized Mn ions, e.g. Mn^{4+} .

F. S.

NOVÁK (FRANTIŠEK) & HOFFMANN (VLADIMÍR). *Výskyt nových nerostů v severovýchodní rudní oblasti Železných hor*. [Occurrence of new minerals in the ore district in the north-eastern part of the Iron Mts.] Rozpravy Československé Akad., 1956, **66**, 31–48. (Russian and English summaries.)

The ore deposits in the Iron Mts. of Algonkian age, consist of oligon spar and pyrite as primary ore minerals, of manganeseous silicates (rhodonite etc.), and pyrrhotite in parts metamorphosed by granite intrusions. At Vápenka veins contain rhodochrosite and quartz as prevalent minerals; among the accessory minerals cronstedtite has now been found, analysis gives SiO_2 17·16, Fe_2O_3 29·22, Al_2O_3 trace, FeO 32·44, MnO 6·34, MgO trace, CaO trace, H_2O 200–400° 10·95, H_2O 400–900° 2·64, H_2O below 200° 1·10, = 99·85. Roentgenometric data are given. New for the ore district are also realgar, barite, marcasite, and galena in veins of later origin.

F. S.

ČERNÝ (PETR). *Anatas a brookit z andesitu od Uherského Brodu* [Anatase and brookite from the andesite near Uhersky Brod.] Časopis Moravského Musea, 1956, **41**, 61–64, 3 figs. (Russian and French summaries.)

An unusual occurrence of anatase in crystals (111) and brookite in tabular or vertically elongated crystals showing (100), (122), (021), (001), (110), has been found in the cavities of an andesite at Komna near Bojkovice, S.E. Moravia.

F. S.

ČERNÝ (PETR). *Bavenit a sdružené nerosty z Drahonína* [Bavenite and associated minerals from Drahonín.] Časopis pro mineralogii a geologii, 1956, **1**, 197–203, 2 figs. (Russian and English summaries.)

In the pegmatite of Drahonín in western Moravia bavenite and a kaolinitic mineral occur as alteration products of beryl, later than the first products—bertrandite and Be-bearing albite. Fibrous aggregates of bavenite consist of elongate individuals with negative elongation, α 1·580, β 1·582, γ 1·587, extinction parallel. Spectral analysis gives for B, Mg, and Fe amounts between 0·01 and 0·1.

F. S.

ČERNÝ (PETR). *Srůsty xenotimu a zirkonu z Drahonína* [Parallel growths of xenotime and zircon from Drahonín.] Spisy přírodovědecké fakulty Masarykovy Univ., 1956, no. **376**, 27–40, 10 figs. (Russian and English summaries.)

In the pegmatite from Drahonín albite, partly of cleavelandite habit, replaces orthoclase and microcline; accessory minerals are garnet (spessartine), arsenopyrite, beryl, bertrandite, zircon, and xenotime. Long prismatic crystals of zircon are surrounded by girdles of dipyramidal xenotime; in radial aggregates of zircon some of its individuals are parallel with xenotime crystals situated in the centre of the aggregate; or the xenotime covers the aggregate superficially. Spectrographic analyses of xenotime, zircon and spessartine are given.

F. S.

ČERNÝ (PETR). *K morfologii epidotu ze Žulové [Contribution to the morphology of the epidote from Žulová.]* Časopis pro mineralogii a geologii, 1956, 1, 280-284, 1 fig. (Russian and English summaries.)

Epidote crystals of orthopinacoid-basal or basal habit from Žulová (formerly Friedeberg) in Czech Silesia show the forms *c, t, b, z, u, o, r, a, f, i, R, C, σ, d, n, M, x, v, y*, (Goldschmidt's letters). On a clinozoisite crystal, the forms *c, t, z, e, Ω, r, S, N* have been observed. F. S.

POKORNÝ (JOEL). *Pegmatitové ložisko v Rožné u Bystřice nad Pernštejnem [The pegmatite deposit of Rožná near Bystřice nad Pernštejnem].* Časopis Moravského Muzea, 1956, 41, 30-48, 3 figs. (Russian and German summaries.)

Detailed description of the differentiation and the paragenesis of minerals in the classical lithium pegmatite of Rožná in western Moravia. F. S.

ČERNÝ (PETR). *Příspěvek k mineralogii síranu ze Smolníku [Contribution to the mineralogy of the sulfates of Smolník].* Spisy přírodovědecké fakulty Masarykovy Univ., 1956, no. 376, 1-26, 7 figs. (Russian and English summaries.)

The pyrite deposit of Smolník (Schmöllnitz, Szomolnok) in eastern Slovakia is rich in secondary sulfates. The author gives analyses of Mg-melanterite (A), Cu-Mg-melanterite (B), Mg-pisanite (C).

	FeO	MnO	CuO	MgO	SO ₃	H ₂ O	Total
A	21.70	—	—	2.63	29.26	46.16	99.75
B	20.25	tr.	3.75	1.60	29.15	46.06	100.81
C	10.42	tr.	9.64	4.29	29.68	46.60	100.63

The succession of sulfates is: halotrichite-melanterite-epsomite-copiaite-botryogen-fibroferrite-apjohnite-slavíkite. For the analysed minerals crystallographic and optical data are given, for slavíkite the structural constants *d* (by Debye-Scherrer method). The figures illustrate crystals of botryogen, epsomite, Mg-melanterite, Mg-pisanite, and the paragenesis of the sulfates. F. S.

[LEPESHKOV (I. N.) & FRADKINA (K. B.)] Лепешков (И. Н.) и Фрадкина (Х. Б.). Карналлит и сингенит в отложениях соляного озера Джаксы-Клыч (Приаралье). [Carnallite and syngenite from the deposits of the salt lake Jaksy-Klych (Aral region).] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, 120, 83-85, 2 figs.

In the deposits of salts of this lake (maximum 5 metres in thickness), the uppermost zone 2 m thick is made of halite; below is a layer of astrakhanite containing crystals of syngenite. Carnallite, bischofite, and a hexahydrate of magnesia were found in other zones. Heating curves of syngenite and carnallite are given. S. I. T.

[LAZARENKO (E. K.)] Лазаренко (Е. К.). Общий минералогический очерк Закарпатья. [A general mineralogical review of the Transcarpathian region.] Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, 11, 102-121.

This is a general review, supported by 90 references, of the formations, rocks and minerals of the Transcarpathian region of the U.S.S.R. It is clearly presented in the form of systematic tables, supported by a text in which the modes of formation of rocks and the paragenesis of minerals are discussed. Igneous, metamorphic and sedimentary rocks are described and also the mineral deposits associated with them—sedimentary brown iron ores, bentonitic clays, salt deposits, marbles, and lead, zinc and mercury deposits of hydrothermal origin.

S. I. T.

RAYNER (E. O.). *Davidite and other radioactive occurrences in the Thackaringa area, Broken Hill District.* Dept. of Mines, New South Wales, 1958 (for 1955), Technical Rept., 3, 62-72, 5 figs.

Davidite occurs in association with ilmenite, rutile, magnetite, and hematite together with quartz and feldspar in pegmatites and aplites in a series of pre-Cambrian metamorphic rocks. A chemical analysis by J. H. Pyle of selected davidite of lustrous black appearance gave SiO₂ 1.33, Al₂O₃ 1.24, BeO 0.01, TiO₂ 50.17, Cr₂O₃ 0.35, V₂O₃ 1.18, Fe₂O₃ 13.06, PbO 0.76, U₃O₈ 4.16, FeO 15.93, Zr₂O₃ 0.12, MnO 0.21, Na₂O 0.07, CaO 0.64, MgO 0.18, ThO₂ 0.08, Ce₂O₃ 1.34, Ce group 6.34, Y group 0.65, CO₂ 0.13, P₂O₅ 0.28, H₂O + 1.43, = 99.66. The various occurrences of dividite are described: monazite, thorite, and carnotite also occur in the vicinity. [M.M. 29-101; M.A. 14-78] R. A. H.

STUGARD (FREDERICK, Jr.). *Pegmatites of the Middletown area, Connecticut.* Bull. U.S. Geol. Survey, 1958, 1042-Q, 613-683.

More than 400 pegmatites, dated by various means at about 260 million years, intrude metamorphosed rocks, schist, mafic gneiss, biotite gneiss, granitic orthogneiss, and tonalitic orthogneiss, for each of which the geologic setting, petrology, mode, and structure are given. The pegmatites (about 300 occur in the schist, 75 in the biotite gneiss and 50 in the mafic gneiss) differ greatly in thickness and in length. They are composed predominantly of microperthite, quartz, plagioclase, and muscovite; beryl and tourmaline are common accessory minerals. Pleochroism of tourmaline in pegmatites is from slate-blue to colorless whereas in the wall rocks tourmaline has the common pleochroism of brown to colorless. Several deposits are described individually. [M.A. 2-26, 6-214, 10-243] K. S.

MITCHELL (R. S.) & GIANNINI (W. F.). *Natrojarosite from near the Montana-Wyoming line.* Amer. Min., 1958, 43, 1205-1210, 1 fig., 1 table.

Natrojarosite, $\text{NaFe}_3(\text{SO}_4)_2(\text{OH})_6$, has been found as a yellow powdery material associated with carbonized wood and gypsum in a fine-grained gray sandstone apparently in the Upper Jurassic Morrison formation. Indexed X-ray powder data are given and unit cell data therefrom are $a = 7.34$, $c = 16.72 \text{ \AA}$, with $a : c = 2.278$. Similar X-ray data were obtained from a sample collected many miles away, suggesting that natrojarosite may be widespread in the Morrison formation in and around the Big Horn Basin. [M.M. 31-407; A. 13-369, 14-72]

B. H. B.

ПТН (Р. Л.). *Some new occurrences of sassolite in the United States.* Amer. Min., 1958, **43**, 1204-1205.

Sassolite, $\text{B}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$, has been described from the Kramer Borate District [Smith, Almond, & Sawyer, ibid. 1968-1978]. Three other known localities are: Steamboat Springs, Washoe County, Nevada; The Geysers, Sonoma County, Calif.; Norris Geyser Basin, Yellowstone National Park, Wyoming.

B. H. B.

SCHOPPEE (LAWRENCE) & SCHOPPEE (HARRIETTE). *Collecting in New Brunswick, Canada.* Rocks and Minerals, 1958, **33**, 7-9.

Numerous mineral collecting localities scattered over New Brunswick are mentioned. Minerals found by the visitors are listed with full instructions on finding the localities.

R. S. M.

ALCK (JOHN N.) & HILDEBRAND (FRED A.). *An occurrence of molybdenian stolzite in Arizona.* Amer. Min., 1958, **43**, 156-159.

Two analyses are reported of stolzite from near Miami, Yuma County, Arizona, containing about 9% MoO_3 . A. P.

INGLE (DON). *Rhodochrosite in Colorado.* Rocks and Minerals, 1958, **33**, 499.

A partial list of Colorado rhodochrosite occurrences.

R. S. M.

ANON. *Himalaya Mine Reopened.* Rocks and Minerals, 1958, **33**, 489.

The Himalaya gem mine at Mesa Grande, San Diego County, California, inactive since 1914, has recently been

re-opened. Tourmaline (pink, green, bi-colored and varicolored), apatite (pinkish-purple), cleavelandite, lepidolite, and quartz are found here.

R. S. M.

GIANNINI (WILLIAM F.) & RECTOR (WILLIAM K., Jr.). *Mineral occurrence and associations in the Albemarle Crushed Stone Quarry (Catoctin Formation) near Shadwell, Virginia.* Virginia Journ. Sci., 1958, **9**, 427.

Minerals from the quarry are grouped into three major associations:—Catoctin greenstone assemblage (in fractures or zones) with calcite, chalcopyrite, malachite, chlorite, epidote, albite metacrysts, specular hematite, magnetite crystals, pink orthoclase, pyrite, quartz, tremolite-actinolite asbestos, and vermiculite; amygdale fillings in greenstone with chalcopyrite (disseminated specks), epidote, chlorite, and green quartz; in rhyolite dikes cutting the greenstone, calcite and dolomite crystals, fluorite (white and purple), and quartz.

R. S. M.

SCHOPPEE (LAWRENCE) & SCHOPPEE (HARRIETTE). *Virginia revisited.* Rocks and Minerals, 1958, **33**, 487-489.

Mineral collecting in the following Virginia localities is described: Rutherford Mine, Amelia (amazonite, moonstone, beryl, spessartine, cleavelandite); Rice (amethyst); Roseland (rutile); Irish Creek (scheelite, siderite, fluorite, arsenopyrite, parisite); Vesuvius (wad, pyrolusite); Spotswood (bauxite, wad, quartz crystals); Crimora (manganese minerals); Timberville (sphalerite, greenockite); Skyline Caverns, Front Royal ('anthrodites'); Leesburg (diabase with prehnite and copper). Details for visiting these occurrences are given.

R. S. M.

PEGAU (ARTHUR A.). *Mineral collecting in Virginia.* Virginia Minerals, 1957, **3**, no. 2, 1-6, 3 figs.

Eight localities of interest to mineral collectors, and directions for visiting them are outlined. References to literature on each deposit are given.

R. S. M.

SINKANKAS (JOHN). *Idocrase from Rockville, Maryland.* Rocks and Minerals, 1958, **33**, 490-491.

Idocrase in a large quarry near Rockville, Montgomery County, Maryland, occurs as translucent, granular, olive-green masses and seams associated with pink grossular and green chrome-diopside in a dark gabbroic rock. Common opal and serpentine are also found in the quarry.

R. S. M.

VARIOUS TOPICS

NIKOLAEV (V. A.)] Николаев (В. А.). О варианности природных систем и применение к ним правила фаз. [On the variance of natural systems and the application of the phase rule to them.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 255-269.

S. I. T.

GLEMSER (O.). *Binding of water in some hydroxides and hydrous oxides.* Nature, 1959, **183**, 943-944, 3 figs.

Infra-red absorption spectra and proton magnetic resonance measurements indicate two new groups of hydroxides: condensed hydroxides, e.g. iron III hydroxides, and non-stoichiometric hydroxides, e.g. aluminium hydroxides.

C. H. K.

REMICK (JEROME H.). *A chart showing the sphere of influence of atoms and ions in minerals.* Amer. Min., 1958, **43**, 166–168, 1 fig.

A. P.

SMITH (J. V.). *The effect of temperature, structural state and composition on the albite, pericline and aclinic-A twins of plagioclase feldspars.* Amer. Min., 1958, **43**, 546–551, 1 fig.

A. P.

PATEL (A. R.) & TOLANSKY (S.). *The etching of crystal cleavages. I. Mica.* Proc. Roy. Soc., 1957, **243**, A, 33–40, 3 figs., 2 pls.

When cleavage flakes of muscovite are treated with HF two types of etch pits are produced: small widely distributed pits and relatively large localized isolated pits. On oppositely matched cleavages there is exact correspondence between the localization and shapes of the isolated pits: the mechanism of their formation is discussed and they are attributed to impurities. On occasional samples winged pits are formed and the wing is shown to be an air wedge within the body of the mica.

R. A. H.

FRUEH (ALFRED J., Jr.). *Some applications of X-ray crystallography to geologic thermometry.* Journ. Geol., 1958, **66**, 218–223.

The presence of ordered domains in minerals can be detected by X-ray diffraction and can be used as an indication of the previous temperature history of the mineral. Bornite, chalcopyrite, and acanthite-argentite are used as examples to illustrate this phenomenon.

H. L.

EGAN (E. P., Jr.) & WAKEFIELD (Z. T.). *Thermodynamic properties of calcium metaphosphate, 10° to 1400°K.* Journ. Amer. Chem. Soc., 1956, **78**, III, no. 17, 4245–4249, 4 tables.

The heat capacity of β -calcium metaphosphate crystals was measured over the range 10–306°K. The heat content, $H^\circ - H_0^\circ$, at 298.16°K is 5715 cal/mole and the entropy at

298.16°K is 35.12 cal/deg/mole. The heat contents of β -crystalline and glassy forms of calcium metaphosphate were measured over the range 373° to 1370°K, and equations for the thermal properties of the material were derived. The α -form of calcium metaphosphate was not observed in this study nor was any attempt made to measure heat transition from the β to α form.

R. C. D.

IRANI (K. S.), SINHA (A. P. B.), & BISWAS (A. B.). *Entropy of hausmannite to spinel transformation.* Proc. Phys. Soc., 1958, **71**, 270–271.

The increase in entropy ΔS when disorder sets in should be between 4.32 and 2.16 cal/deg/mole. It is reasonable to assume that in Mn_3O_4 most of the Mn^{3+} ions still occupy the octahedral sites and thus ΔS should be only slightly lower than 4.32 cal/deg/mole.

R. A. H.

YOSHINGA (M.). *A thermodynamic study of equilibrium relations among some manganese minerals introduced during the epoch of thermal metamorphism.* Journ. Mineral. Soc. Japan, 1958, **3**, 406–417 [in Japanese]. English abstr. in Min. Journ. [Japan], 1958, **2**, 180.

PT equilibrium relations are calculated for the reaction $MnCO_3 = MnO + CO_2$; $MnCO_3 + SiO_2 = MnSiO_3 + CO_2$; $2MnCO_3 + SiO_2 = Mn_2SiO_4 + 2CO_2$; $MnCO_3 + MnSiO_3 = Mn_2SiO_4 + CO_2$. At high temperatures manganosite is the stable form: at lower temperatures, with pressures up to 5000 atm, tephroite is thermodynamically more stable than rhodonite [M.M. 27–236].

R. A. H.

KOPP (O. C.) & KERR (P. F.). *Differential thermal analysis of sphalerite.* Amer. Min., 1958, **43**, 732–748, 8 figs., 7 tables.

For sphalerite a relationship exists between iron content and differential thermal reaction temperature, for samples heated in air. Sulfur dioxide and zincite are the chief thermal reaction products, zinc ferrite or magnetite appear if the iron content is high. Samples ranging from less than 0.1% Fe to 13% Fe were analysed and peak temperatures decreased regularly from 821°C to 767°C respectively. For quantitative results: the heating rate should be between 10 to 15°C/min and vary not more than 1°C/min; the grain size should lie in the range 125–149 μ (100–120 mesh); and sample weight lie within the range 40 to 60 mg varying not more than about 2 mg. Presence of Pb, Cu, Mn, or Cd, or of exsolved pyrrhotite can lead to erroneous measurements.

B. H. B.

KOPP (O. C.) & KERR (P. F.). *Differential thermal analysis of pyrite and marcasite.* Amer. Min., 1958, **43**, 1079–1097, 6 figs., 11 tables.

Differential thermal analyses of pyrite and marcasite

ow distinctive curves with initial oxidation peaks at bout 538° and 460°C respectively, suggesting a lower ability for marcasite. Samples of 50 mg (125–149 μ fraction) were used. Thermogram shapes vary and peak temperatures decrease with decreasing grain size; the endothermic Curie point increases with decreasing grain size. Peak areas increase with sample weight and thermograms show more detail for samples heavier than 30 mg. Minor de reactions, possibly due to oxygen depletion, appear with increasing sample weight. Possible intermediate reaction products are maghemite, magnetite, and pyrrhotite; at 100°C the products are hematite and SO₂.

B. H. B.

FROVÁ (DANA). *Výzkum modifikaci CaCO₃ ve schránkách foraminifer [An investigation of modifications of CaCO₃ in the shells of foraminifera]*. Časopis pro mineralogii a geologii, Praha, 1956, **1**, 101–104. (Russian and English summaries.)

Meigen's reaction for distinguishing calcite from aragonite in the shells of foraminifera points to aragonite, but X-rays indicate the diffraction pattern of calcite. The result of Meigen's reaction may be accounted for by a difference in degree of crystallinity of the calcite.

J. N.

RADBRUCH (DOROTHY H.). *Hypothesis regarding the origin of thinolite tufa at Pyramid Lake, Nevada*. Bull. Geol. Soc. America, 1957, **68**, 1683–1688, 3 figs., 1 pl.

Calcium carbonate tufa in the form of delicate elongate skeletal crystals known as thinolite is described: these crystals are mostly terminated at both ends by pyramids and are made up of very small calcite crystals possibly after aragonite [Jones, J. C., Publ. Carnegie Inst. Washington, 1925, no. 352]. It is suggested that the thinolite crystals or their antecedent crystals were not directly precipitated from lake waters, but formed in fine calcareous muds inside tufa domes, or as isolated crystals in bottom sediments.

R. A. H.

LIÈGEOIS (P. G.). *Découverte de perles de cavernes de formation curieuse dans la grotte de Florefe*. Ann. (Bull.) Soc. géol., Belgique, 1954–55, **78**, B23–25.

A propos des perles de cavernes et concrétions analogues non encore décrites. Ibid., 1956–57, **80**, B165–169, 2 figs.

Description of calcareous concretions of remarkable shape; their extent in Belgian caves.

J. M.

RUNNELS (RUSSELL T.), SCHLEICHER (JOHN A.), & VAN NORTWICK (H. S.). *Composition of some uranium-bearing phosphate nodules from Kansas shales*. Bull. Kansas Geol. Survey, 1953, **102**, pt. 3, 93–104, 3 figs.

The average chemical composition of 11 samples of phos-

phate nodules from 7 Pennsylvanian shales included 30·2% P₂O₅, 0·017% U₃O₈, and 3·2% F. X-ray diffractometer traces of three nodule specimens, one brown rock phosphate, one crystalline fluorapatite, suggest that the phosphate mineral of the nodules is carbonate-fluorapatite. A. Sw.

MITCHELL (RICHARD S.) & SHERWOOD (W. CULLEN). *Spherulitic phosphate concretions from Big Horn Basin, Wyoming*. Virginia Journ. Sci., 1957, **8**, 333–334.

Dahllite pseudomorphs after pyrite concretions from Big Horn Basin, Wyoming. Amer. Min., 1958, **43**, 600–603, 2 figs.

Thin sections show that the light-gray dahllite spherulites, from the Thermopolis formation (Upper Cretaceous) in Big Horn Basin, Wyoming, are pseudomorphs after spherulitic pyrite. These concretions, which average one inch in diameter, also contain kaolinite, goethite, hematite, and unreplaceable pyrite.

A. P. & R. S. M.

SCHEERE (J.). *Des intercalations à sphérolithes dans les couches de houille. Modes d'occurrence et conditions de genèse*. Publ. Assoc. Étude Paléont. Stratigr. Houillères, Brussels, 1955, no. **21**, 345–356, 1 fig., 2 pls.

Spherulitic chalybite (four analyses) frequently occurs as lenticles or thin layers interbedded in Belgian coal seams. Its origin is primary, but replacement by pyrite is often observed.

R. V. T.

VAN TASSEL (R.). *Étude pétrographique de quelques sidéroses à globules argileux du Westphalien belge*. Publ. Assoc. Étude Paléont. Stratigr. Houillères, Brussels, 1955, no. **21**, 361–379, 2 pls.

Ironstones from six localities show ooliths ($1\frac{1}{2}$ mm) of kaolinite and isotropic clay in a groundmass of granular chalybite. Minute tabular crystals (max. 130 μ) of apatite (ω 1·632, X-ray spacings given) sometimes occur within the ooliths [M.M. **25**–135].

J. Ph.

KIMPE (W. F. M.). *Unusual specimens of vertical cone-in-cone in Dutch coal*. Publ. Assoc. Étude Paléont. Stratigr. Houillères, Brussels, 1955, no. **21**, 91–97, 1 pl.

R. V. T.

ANON. 'Walnut' marcasite nodules from Norwood, Michigan. Rocks and Minerals, 1958, **33**, 509.

Marcasite nodules found embedded in the Antrim formation (a Devonian-Mississippian shale) at Norwood, Charlevoix County, Michigan, are usually walnut-like in shape, ranging to over 3 inches in diameter.

R. S. M.

SQUIRES (S. J.). *Interesting discovery*. Rocks and Minerals, 1958, **33**, 27.

A brief description of a quartz crystal, from the Harts Range of Central Australia, which contains about 2 cc of fluid in a cavity 2 inches long and $\frac{1}{2}$ inch wide. The crystal is five inches long.

R. S. M.

CROSS (WHITMAN, II) & PEARL (R. K.). *Implications of smoky phantoms in rock crystal quartz near Craigsville, Virginia.* Virginia Journ. Sci., 1958, **9**, 430.

Smoky quartz phantoms are found in clear rock crystals, up to 15 mm in length, at the Gay Quarry, 2 miles S.E. of Craigsville, Virginia, which are associated with calcite rhombohedrons in the cherty limestone of the Upper Helderberg. Thin section study showed that the smoky appearance of the included crystals is caused by impurity cappings during growth. Magnified 450 times some of the impurity appeared crystalline with optical properties suggesting tourmaline.

R. S. M.

[SKROPYSHEV (A. V.)] Скропышев (А. В.). Газово-жидкие включения в кристаллах исландского шпата. [Gas-liquid inclusions in the crystals of Iceland spar.] Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. **11**, 302–321, 4 figs.

Primary and secondary gas-liquid inclusions are classified into eleven types and are described. The composition of the fluids and their temperatures during the growth of crystals are determined. It is shown that the solutions were highly concentrated (368 g/litre) and that they contained Na_2SiO_3 , NaCl , KCl , AlCl_3 , CaCl_2 , CaSO_4 , and $\text{Ca}(\text{HCO}_3)_2$. According to the temperature of the mother fluids the crystals studied fall into four types: 60° , 160 – 200° , 115 – 147° , 105 – 127°C . The best quality crystals of Iceland spar were formed at a higher temperature.

S. I. T.

ROST (RUDOLF). *Mikroskopické těžké minerály Jizerské louky* [Microscopic heavy minerals of the Jizerská louka]. Časopis pro mineralogii a geologii, 1956, **1**, 252–259, 5 pls. (Russian and English summaries.)

The microscopic study of the concentrates from the Jizerská louka ('mead of the river Jizera') in northern Bohemia indicates that the heavy minerals are derived from granites with pegmatites in the neighbourhood. The author gives details of the crystal forms and optical properties of the heavy minerals, and critical discussions of former determinations. The 'iserine', described from this locality, the author proves, in accordance with the recent investigation of Chevalier, Bolfa and Mathieu [Bull. Soc. franç. Min. Crist., **78**, 307, 365] as homogeneous monocrystals of ilmenite; 'iserine' is considered a 'discredited mineral'.

F. S.

NAKHLA (F. M.). *Mineralogy of the Egyptian black sands and its applications.* Egypt. Journ. Geol., 1958, **2**, no. 1, 1–22, 4 pls., 6 figs. (Summary in Arabic, ibid., 23–24.)

The results of mechanical analysis and quantitative mineralogical determination for a sample of black sand from Rosetta are given. The method used is based on fractionation by sieving and magnetic separation with alloy horse-shoe magnet. Mineralogical examination carried out by reflected and transmitted light.

E. M. El S.

VAN TASSEL (R.). *Une fulgurite ramifiée de Zutendaal Limbourg belge.* Bull. Inst. roy. Sci. nat. Belgique, 1958, **34**, no. 7, 9 pp., 1 pl.

A nearly vertical, 8·4 m long, incomplete fulgurite has been observed in white Miocene sand. The tube shows two and threefold ramification, but no spiral structure. Black cellular globules ($\frac{1}{4}$ – $\frac{1}{2}$ mm) inside the upper parts of the tube indicate that the lightning followed a path along a rod. Lechatelierite [M.A. **8**–62; M.M. **25**–436] has $n 1\cdot461$. The plate shows the fulgurite in situ [M.A. **13**–196].

J. Ph.

REED (J. J.) & SEELYE (F. T.). *The nature and composition of pseudo-fulgurite tubes discovered in sand dunes near Levin.* New Zealand Journ. Sci. Techn., 1951, **32**, no. 4, 1–7, 5 figs.

Irregular tube-like objects externally similar to fulgurites are shown to be pseudo-fulgurites formed by the replacement of wood by impure hydrated silica (opal). An analysis of one of the pseudo-fulgurites is given.

W. A. W.

REED (M. N.). *Fulgurites in the making.* Rocks and Minerals, 1958, **33**, 406.

Near Cleator, Arizona, the formation of a fulgurite was observed during a rainstorm. Lightning struck a high voltage power line and then leaped to the soil. The cavity in the resulting fulgurite, which is about the size of a finger, is lined with silica glass and contains a strand of copper wire fused to it.

R. S. M.

SKINNER (BRIAN J.). *Huntite from Tea Tree Gully, South Australia.* Amer. Min., 1958, **43**, 159–162.

Huntite, $\text{Mg}_3\text{Ca}(\text{CO}_3)_4$, occurs as a weathering product of the Proterozoic, Torrens Dolomite, near Tea Tree Gully, South Australia. An X-ray powder diffraction pattern of 77 lines is recorded. Not all of these lines can be indexed on the cell previously assigned. [A.M. **38**–4; M.A. **12**–13; **14**–80]

A. P.

MUESSIG (SIEGFRIED). *First known occurrence of inyoite in a playa, at Laguna Salinas, Peru.* Amer. Min., 1958, **43**, 1144–1147, 1 fig.

Inyoite, $\text{Ca}_2\text{B}_6\text{O}_{11}\cdot13\text{H}_2\text{O}$, occurs in a discontinuous band up to 15 cm thick near the surface of a playa in the Laguna

linas, Peru. It is overlain by a bed of ulexite and a surface layer of recent (?1600 A.D.) volcanic ash. The pyrope is primary and formed as crystal aggregates in enclosing muds. The crystals are pseudorhombohedra with {01} and {110} the dominant forms.

B. H. B.

LLEN (ROBERT D.) & ALMOND (H.Y.). *Nonfibrous ulexite from the Kramer District, California*. Amer. Min., 1958, **43**, 169-170.

Vitreous, nonfibrous, ulexite embedded in borax and clay found to contain 1.08% SrO.

A. P.

TEINER (A.). *Occurrence of wairakite at The Geysers, California*. Amer. Min., 1958, **43**, 781.

Wairakite, the lime analogue of analcime, has been identified in greywacke from The Geysers, California; it is a replacement of feldspar and lines cavities in the greywacke.

M.M. 30-691, 699]

B. H. B.

KIRIYAMA (R.) & AZUMI (M.). *Optical anomaly of analcime from Mazé, Niigata Prefecture*. Journ. Min. Soc. Japan, 1958, **3**, 418-423 [in Japanese]; English summary in Min. Journ. [Japan], 1958, **2**, 281.

A transparent icositetrahedral crystal of analcime from Mazé has a double refraction of 0.0003; a 13.70 Å. After heating at 300°C for 4 hours the double refraction increased to 0.001 and the lattice was distorted to probable tetragonal symmetry with a 13.70, c 13.55 Å. [M.A. 1-156]

R. A. H.

DIETRICH (R. V.). *Chromian muscovite from Baker Mountain, Virginia*. Amer. Min., 1958, **43**, 162-165.

An analysis listing 19 constituents is reported for a 2M chromian muscovite (Cr_2O_3 0.17%) found with kyanite, rutile, and quartz.

A. P.

HARIYA (YU) & HARADA (Z.). *Studies on manganese-wads from some localities in Hokkaido*. Journ. Min. Soc. Japan, 1957, **3**, 300-313.

X-ray powder methods show that wad from three localities in Hokkaido is a mixture of manganese minerals such as pyrolusite, cryptomelane, ranciéite, and birnessite. Electron microscope and d.t.a. investigations are also reported.

R. A. H.

[SINITZA (S.)] Синица (С.). К минералогии марганцевых руд хребта Прелужного в Чивчинских горах. [On the mineralogy of manganese ores of the Preluzhnyi ridge in the Chivchin mountains.] Мнинер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. **11**, 170-186, 16 figs.

Descriptions, chemical analyses, and optical data are given of the following minerals: rhodochrosite, rhodonite, spessartine, pyroxmangite, bementite, epidote, högbomite, and manganocalcite.

S. I. T.

BOSE (MIHIR KUMAR). *Goethite-hematite relation—an ore microscope observation*. Amer. Min., 1958, **43**, 989-990, 1 fig.

Thin plates of hematite, aligned parallel to the fibre axes of the host, are included in goethite from Singhbhum, India. A replacement origin is suggested.

A. P.

MARUMO (F.). *On the ninelings of cassiterite from Naégi, Gifu Prefecture*. Journ. Min. Soc. Japan, 1957, **3**, 228-233.

The ninelings of cassiterite from the Ebisu mine and from placer deposits are ideally composed of a host crystal and eight individuals each having a twin relationship on {011} with the host. Zonal structure in the nineling is taken to imply that the twin originated at an early stage of crystal growth.

R. A. H.

EMBREY (P. G.). *Condurrite: a mixture and not domeykite*. Min. Mag., 1958, **31**, 979-980.

Eight 'condurrite' specimens from Condurrow mine and from Wheal Druid, Cornwall, have been shown to be mixtures of cuprite, melaconite, chalcocite, and either domeykite or β -domeykite (though not all are present in any one sample).

R. A. H.

[KOSTOV (IVAN)] Костов (Иван). Эпитаксическое наростание галенита на пирите. [Epitaxic growth of galena on pyrite.] Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. **11**, 38-41, 5 figs.

Regular growth of cubic crystals of galena on the cube faces of pyrite is described and other types of epitaxic growth of galena on pyrite are discussed.

S. I. T.

ROSE (H. J., Jr.), BLADE (L. V.), & ROSS (MALCOLM). *Earthy monazite at Magnet Cove, Arkansas*. Amer. Min., 1958, **43**, 995-997, 1 fig.

The earthy monazite is in irregularly shaped crystals and aggregates of crystals averaging 0.5μ in diameter. It is believed to be the product of weathering of the rare-earth bearing apatite of an apatite-pyrite vein in carbonatite.

A. P.

[BESKROVNY (N. S.)] Безкровный (Н. С.). Нефтепроявления в вулканических трубках Сибирской платформы. [Petroleum occurrences in volcanic pipes of the Siberian platform.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **122**, 119-122, 2 figs.

Bitumen, in consistency varying from petroleum to asphalt, is frequently found, often associated with calcite, sulphur, and quartz, in cavities and cracks of kimberlite pipes and adjoining contact rocks in the Vilui basin and other localities in Siberia. Several analyses of bitumen are given.

S. I. T.

[PETERSILIE (I. A.)] Петерсилье (И. А.). Углеводородные газы интрузивных массивов центральной части Кольского полуострова. [Hydrocarbon gases in the intrusive massifs of the central part of the Kola peninsula.] Доклады Акад. Нauk CCCP [C.R. Acad. Sci. U.S.S.R.], 1958, **122**, 1086–1089, 3 figs.

Appreciable quantities of methane and related hydrocarbons, hydrogen, and other gases occur in the ijolite-turite series of intrusive rocks of the Khibina Tundra. The gases from open pores and cracks differ in composition from those contained in closed pores. As the amount of gases contained in the surrounding sedimentary and effusive rocks is very small, it is suggested that the gases contained in the Khibina Tundra igneous rocks are of an inorganic origin.

S. I. T.

WAGER (L. R.). *Beneath the earth's crust*. Advancement of Science, 1958, no. **58**, 1–14 (British Association, Glasgow Meeting, Sect. C Presidential Address).

A review of current hypotheses on the constitution of the earth's mantle is presented. An analogy is made between the mode of formation of layered intrusions and a possible origin of the silicate shell of the earth.

W. S. M.

BOTT (M. H. P.) & MASSON-SMITH (D.). *The geological interpretation of a gravity survey of the Alston block and the Durham coalfield*. Quart. Journ. Geol. Soc., 1957, **113**, 93–118, 6 figs., 2 pls.

A large negative anomaly is held to indicate the presence of a concealed post-Carboniferous granite. R. StJ. L.

BOTT (M. H. P.) & MASSON-SMITH (D.). *Interpretation of a vertical field magnetic survey in north-east England*. Quart. Journ. Geol. Soc., 1957, **113**, 119–136, 3 figs., 2 pls.

A negative magnetic anomaly over the Alston block supports the theory of a concealed post-Carboniferous granite. R. StJ. L.

RENWICK (A.) & FLINTER (B. H.). *The application of a punched card system for indexing rocks and minerals*. Overseas Geol. Min. Resources. London, 1958, **7**, no. 36–44.

Describes the system used by the Malayan Geological Survey, employing 'Findex' equipment, for cross-indexing extensive collections. The designs of the cards are figured and the coding systems for rocks and for minerals are listed and explained.

T. D.

[ROMANOVA (M. A.)] Романова (М. А.). Результаты опытного аэрапетрографической съемки современных песков северо-западного Прикаспия. [The experimental aeropetrographical mapping of modern sands in the north-western part of the Caspian region.] Доклады Акад. Нauk CCCP [C.R. Acad. Sci. U.S.S.R.], 1958, **120**, 625–628, 2 figs.

An attempt is made to use spectrographic intensity as an indicator of the nature of the rock as seen from an aeroplane. By means of a specially constructed apparatus—spectrograph coupled to a photographic camera—the distribution of sands was mapped.

S. I. T.

ABBREVIATIONS AND SYMBOLS

used in the text of abstracts

M.M. . . Mineralogical Magazine : M.A. . . Mineralogical Abstracts : A.M. . . American Mineralogist

CHEMICAL & PHYSICAL-CHEMICAL

cation-exchange-capacity	...	c.e.c.
differential thermal analysis	...	d.t.a.
equivalent U ₃ O ₈	...	eU ₃ O ₈
ethylenediaminetetra-acetic acid	...	EDTA
heat of formation (absolute temperature subscript)	...	ΔH _f
ionic potential, e.g.	...	pH
insoluble residue	...	insol. res.
isotopes, e.g.	...	⁴⁰ A, ⁴⁰ K
loss on ignition	...	ign. loss
milliequivalent	...	me.
microgramme	...	μg
million-years	...	m.y.
not determined	...	n.d.
not found	...	nt. fd.
not present	...	nil
parts per million	...	p.p.m.
strength of solution, normal	...	N
— — — molar	...	M
substances in ionic state		
anions, e.g.	...	Cl ⁻ , SO ₄ ²⁻
cations, e.g.	...	K ⁺ , Fe ³⁺
valency, e.g.	...	Cl ^I , Fe ^{II} , Fe ^{III}

CRYSTALLOGRAPHIC & STRUCTURAL

Ångstrom unit (10 ⁻⁸ cm)	...	Å
crystal axes	...	a, b, c
— face indices	...	(hkl)
— form indices	...	{hkl}
— zone indices	...	[hkl]
indices of X-ray diffractions	...	hkl
intensity,	...	I
— relative	...	I/I ₀
interplanar spacing	...	d
mica structural polymorphs	...	1M ₁ , 2M ₁
Siegbahn units	...	kX
space group. These words will be written in full		
unit cell, formula units	...	Z
— repeat distances	...	a, b, c
— reciprocal lattice lengths of edges	...	a*, b*, c*
— interaxial angles		
direct lattice	...	α, β, γ
reciprocal lattice	...	a*, β*, γ*

OPTICAL

dispersion, e.g.	...	r > v
extinction angle, e.g.	...	γ : c
optic axial angle	...	2V
— plane	...	O.A.P.
refractive index, in text	...	refr. ind.
— — — of isotropic mineral	n	
refractive indices		
of uniaxial mineral	...	ω, ε
of biaxial mineral	...	α, β, γ
sign of biaxiality		
negative	...	— or 2V
positive	...	+ or 2V

PHYSICAL (other)

calorie	...	cal.
calorie, large	...	kcal.
cycles per second	...	c/s
degree centigrade	...	°C
density	...	D (quote units)
— , relative, e.g.	...	D ₂₀
gramme	...	g
hardness	...	H.
melting-point	...	m.p.
micron (10 ⁻⁶ cm)	...	μ
millimicron (10 ⁻⁷ cm)	...	μμ
pounds per square inch	...	lb/in ²
soluble	...	sol.
specific gravity, terms of reference not known	...	sp. gr.
wavelength	...	λ

SYMBOLS

approximately equal to	...	≈
equal to	...	=
equal to or greater than	...	≥
equal to or less than	...	≤
greater than	...	>
less than	...	<
not equal to	...	≠
parallel to	...	
per cent.	...	%
per mille	...	‰
perpendicular to	...	⊥
proportional to	...	∞

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